LYNXTechnik AG

Broadcast Television Equipment

Reference Manual

P VD 5660 D

P VD 5660 B

Dual Channel SD/HD Multi-format Frame Synchronizer with Full Embedded and External AES Audio Support

Revision 2.6 – November 2010

This Manual Supports Device Revisions:	
P VD 5660 Firmware Revision	402
Control System GUI Release	4.8.2

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Warranty

LYNX Technik AG warrants that the product will be free from defects in materials and workmanship for a period of two (2) year from the date of shipment. If this product proves defective during the warranty period, LYNX Technik AG at its option will either repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, customer must notify LYNX Technik of the defect before expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by LYNX Technik, with shipping charges prepaid. LYNX Technik shall pay for the return of the product to the customer if the shipment is within the country which the LYNX Technik service center is located. Customer shall be responsible for payment of all shipping charges, duties, taxes and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure, or damage caused by improper use or improper or inadequate maintenance and care. LYNX Technik shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than LYNX Technik representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non LYNX Technik supplies; or d) to service a product which has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty servicing the product.

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Regulatory information

Europe

Declaration of Conformity

We LYNX Technik AG
Brunnenweg 3
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Germany

Declare under our sole responsibility that the product

TYPE: **P VD 5660 B, P VD 5660 D**

To which this declaration relates is in conformity with the following standards (environments E1-E3):

EN 55103-1 /1996
EN 55103-2 /1996
EN 60950 /2001

Following the provisions of 89/336/EEC and 73/23/EEC directives.

Winfried Deckelmann

Weiterstadt, August 2008

Place and date of issue *Legal Signature*

USA

FCC 47 Part 15

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Getting Started

Most CardModules are installed into the rack frames and system tested in the factory. If this is an upgrade part or service exchange item then the module is supplied in a padded cardboard carton which includes the CardModule, rear connection plate and mounting screws.

Packaging

The shipping carton and packaging materials provide protection for the module during transit. Please retain the shipping cartons in case subsequent shipping of the product becomes necessary. Do not remove the module from its protective static bag unless observing adequate ESD precautions. Please see below.

ESD Warning

This product is static sensitive. Please use caution and use preventative measures to prevent static discharge or damage could result to module.

Preventing ESD Damage

Electrostatic discharge (ESD) damage occurs when electronic assemblies or the components are improperly handled and can result in complete or intermittent failure.

Do not handle the module unless using an ESD-preventative wrist strap and ensure that it makes good skin contact. Connect the strap to any solid grounding source such as any exposed metal on the rack chassis or any other unpainted metal surface.

Caution

Periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 Megohms.

Product Description

The P VD 5660 FLEXCARD is a high performance dual channel SD/HD frame synchronizer / line synchronizer with full embedded and external AES audio support. Basic functionality is a single channel multi format frame synchronizer and SDTV ARC.

The module provides support for AFD (Active Format Description), WSS (Wide Screen Signaling) and VI (Video Index) for automated control of the optional converter stages. Transparency resp. conversion of embedded Metadata is also ensured, including Time Code and Closed Caption.

Dolby E processing is included in the audio processing stages, i.e. encoded Dolby E streams are synchronized to the Reference Signal and the Guard Band is automatically aligned.

Firmware options provide the ability to easily add additional functionality which include:

- Second Input *(option code OC-5660-SCND)*
- 2 Channels of Basic Down Conversion *(option code OC-5660-DWN)*
- Single channel of HQ UP/DOWN/CROSS conversion *(option code OC-5660-UPXD)*
- Single channel of HQ Noise Reduction *(option code OC-5660-NR)*

Firmware options can be added at any time with a license code. No hardware or Firmware modifications are required.

Input Video Formats

The module has two multi-format serial digital inputs (second input is optional) with automatic input detection. The module will detect the following input standards and configure the input stage automatically for operation in the connected format.

SDTV Formats	HDTV Formats
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
	1080p / 23.98Hz
	1080p / 24Hz
	1080p / 25Hz
	1080p / 29.97Hz
	1080p / 30Hz
	1080psf / 23.98Hz
	1080psf / 24Hz
	1080psf / 25Hz
	720p / 23.98Hz
	720p / 24Hz
	720p / 25Hz
	720p / 29.97Hz
	720p / 30Hz
	720p / 50Hz
	720p / 59.94Hz
	720p / 60Hz

Note. As the synchronizer uses a single studio reference input both input signals should be the same input frequency (frame rate) as the reference for normal operation. (Formats can be different but the frame rate must match; for example:

Input 1 = 1080i/59.94Hz and Input 2 = 525 59.94Hz with a 59.94Hz reference is valid.
Input 1 = 1080i/59.94Hz and Input 2 = 720P/50Hz with a 59.94Hz reference is not valid and input 2 will have a disturbed or corrupted output signal.

Output Video Formats

The module provides eight SDI outputs, user assignable in four sets of two outputs; these sets can be mapped independently to any of the two input channels. Supported output video formats are:

SDTV Formats	HDTV Formats
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
	1080p / 23.98Hz
	1080p / 24Hz
	1080p / 25Hz
	1080p / 29.97Hz
	1080p / 30Hz
	1080psf / 23.98Hz
	1080psf / 24Hz
	1080psf / 25Hz
	720p / 23.98Hz
	720p / 24Hz
	720p / 25Hz
	720p / 29.97Hz
	720p / 30Hz
	720p / 50Hz
	720p / 59.94Hz
	720p / 60Hz

The output format frequency (or frame rate) is determined by the connected reference signal and the output will remain fixed to this reference regardless of the connected input signals.

For input signals mismatched to the connected reference frame rate, the synchronizer will show this as an asynchronous source (indicated by a yellow status indication in the GUI) and any output signal derived from this “async” source can show video disturbances (see below “Reference Lock”)

NOTE: For down conversion or HQ up / down / cross conversion additional firmware options are required. Without these options installed the frame synchronizer passes the video in the connected input format. (SDTV Aspect Ratio Conversion functionality is included as part of the basic module).

Input Reference Signal

The module has a very flexible input reference stage which facilitates the use of either SDTV analog bi-phase sync (i.e. black burst) or HDTV analog tri-level sync. The reference input is “cross lock” compatible so an SDTV reference can be used to frequency lock HDTV signals (and vice versa). The connected reference is auto detected and the synchronizer automatically configures the outputs to the frame rate of the connected reference signal.

Supported reference signals are shown below.

SDTV Analog Bi-Level Sync	HDTV Analog Tri-Level Sync
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
	1080p / 23.98Hz
	1080p / 24Hz
	1080p / 25Hz
	1080p / 29.97Hz
	1080p / 30Hz
	1080psf / 23.98Hz
	1080psf / 24Hz
	1080psf / 25Hz
	720p / 23.98Hz
	720p / 24Hz
	720p / 25Hz
	720p / 29.97Hz
	720p / 30Hz
	720p / 50Hz
	720p / 59.94Hz
	720p / 60Hz

Reference Lock

If the input frame rate, the output frame rate and the frame rate of the reference signal are equal, exactly half of each other or double of each other then all modes of the P VD 5660 operate with no limitations:

- All 25 Hz and 50 Hz input formats will be synchronized to any 25 Hz or 50 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 25 Hz or 50 Hz.
- All 30 Hz and 60 Hz input formats will be synchronized to any 30 Hz or 60 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 30 Hz or 60 Hz.
- All 29.97 Hz and 59.94 Hz input format will be synchronized to any 29.97 Hz or 59.94 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 29.97 Hz or 59.94 Hz.
- All 23.98 Hz input formats will be synchronized to any 23.98 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 23.98 Hz.
- All 24 Hz input formats will be synchronized to any 24 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 24 Hz.

NOTE: If the frame rate of the reference signal is not equal, double or half of the input/output frame rate, then all functions still are available except the video delay as the frame rate of the output video does not match the frame rate of the reference signal. The video output remains frequency locked to the Reference signal.
In this case a synchronized Dolby E signal ***will not match*** the required guard band of the video output signal.

NOTE: If the input frame rate, the output frame rate and the frame rate of the reference signal do not match then the module's converters (if activated) will perform a rudimentary frame rate conversion with drop and repeat frames. This mode of operation is not a recommended or specified functionality for the P VD 5660, and unwanted artifacts may occur.

Frame Synchronization

Two independent frame synchronizers are provided, one for each input channel. (Second input is optional). The algorithms used are extremely robust and very tolerant of poor input signals. The Synchronizers use "Flywheel" functionality. This allows the module to recover from any missing sync pulses on the input signal(s) by predicting where they should be and then re-inserting them.
If no converters are active, the frame synchronizer passes the video in the connected input format.

The Synchronizers can also be switched into a Line Synchronizer Mode (see page 45)

ARC (Aspect Ratio Conversion)

The basic module includes three independent ARCs (**A**spect **R**atio **C**onverters) which can be used to convert SDTV signals between 4:3 or 16:9 aspect ratios. Two of the ARCs are fixed in mode and are basic in operation suited better for fixed monitoring applications. The third ARC is a high quality image processor which has extended functionality including manually adjustable image size and position. The three ARCs are internal resources which can be routed to any input signal and any of the four available outputs.

Modes supported are as follows:

Conversion from 16:9 to 4:3 Aspect Ratio

Letterbox

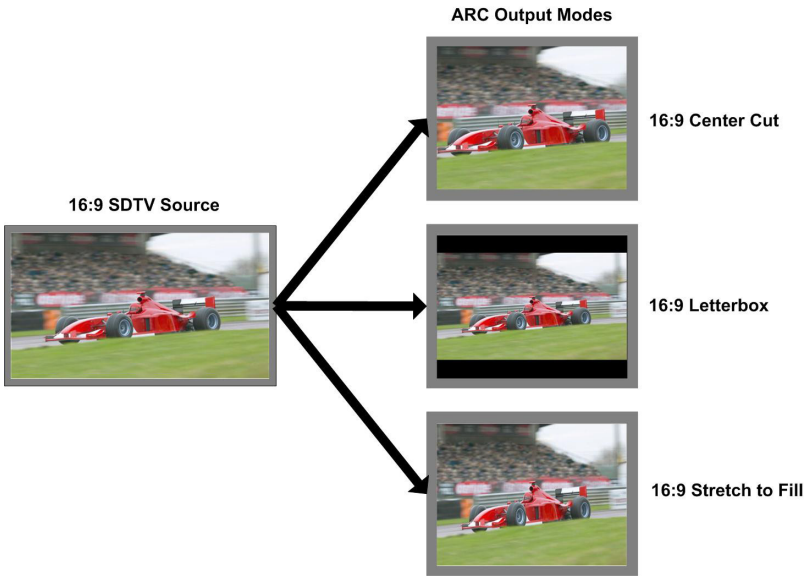
This takes the 16:9 aspect ratio of the input signal and fits it horizontally into the 4:3 SD image area with black bars at the top and bottom of the image.

Center Cut

This mode cuts the center portion of the 16:9 input signal and fills the 4:3 SD image area

Stretch to Fill

This mode takes the 16:9 input signal and distorts (vertically stretches) the image to fit the available 4:3 SD image area.

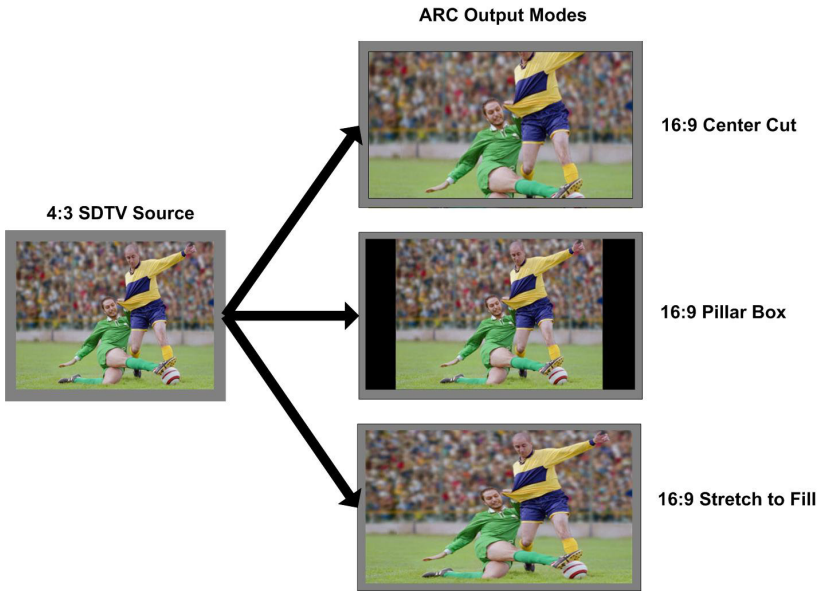


Conversion from 4:3 to 16:9 Aspect Ratio

PillarBox
This takes the 4.3 aspect ratio of the input signal and fits it vertically into the 16:9 SD image area with black bars at the left and right of the image.

Center Cut
This mode cuts the horizontal center portion of the 4:3 input signal and fills the 16:9 SD image area (cropping the top and bottom of the image)

Stretch to Fill
This mode takes the 4:3 input signal and distorts (horizontally stretches) the image to fit the available 16:9 SD image area



ARC Image Size and Positioning

The single high quality ARC provides the ability to manually adjust image position and size for the conversion process.
A 14:9 conversion setting is also added.
Please refer to the GUI section of this manual for more information of the controls provided and how to use them.

Note: The converters can by automatically controlled by AFD (Active Format Description), WSS (Wide Screen Signaling) and VI (Video Index). Please refer to the GUI section of this manual for more information of the controls provided and how to use them.

Video Processing

Proc Amp Functions

Each of the four output channels has an associated video processing amp which provides user adjustable ***Gain*** / ***Saturation*** / ***Black Level*** and ***Hue*** using on screen sliders.

Aperture Correction

An adjustable horizontal aperture corrector is provided for each of the four output channels. This can be used to add (or remove) image sharpness as required.

> ***Note.*** *When using the down converter the filtering process results in a very slight loss of high frequency information (which is normal), the aperture corrector can be used to compensate for this slight loss.*

Test Patterns

Each of the four output channels has its own independent test pattern generator which provides a wide selection of test patterns which can be switched into each output.

The selected test pattern is also available as one of the modes the synchronizer will switch to when excessive video TRS errors are encountered. Possible synchronizer actions when the input video errors become excessive are:

- Freeze Field 1
- Freeze Field 2
- Freeze Frame
- Selected Test Pattern
- Black

Programmable Video Output Delay

Each of the four SDI outputs has separate programmable video output delay which can be set (independently) between 0 and 3 frames (max). The adjustment is available in pixel, line and full frame increments.

> **Note** *The Synchronizer (including the OC-5660 DWN, and or OC-5660-UPXD options, if installed) has fixed frame delays depending on the signal path and selected function (see below). The 0 > 3 frame user adjustment is additional delay relative to the fixed delays.*

This adjustment will delay the SDI video output relative to the connected reference by the delay setting specified. (+ fixed delay)

Fixed Processing Delays

The Synchronizer (including the OC-5660 DWN, and or OC-5660-UPXD options, if installed) has fixed frame delays depending on the signal path and selected function - see below:

If signals are routed through the **OC-5660-DWN** Converters the delays are as follows:

Input Standard	Output Standard	Delay (ms)	Delay (Frames - rounded to ½ frame)
1080i 50	625	79	2
720P 50	625	59	1.5
1080p 25	625	79	2
1080i 59.94	525	65	2
720p 59.94	525	65	2
1080p 29.97	525	65	2
625	625	39	1
525	525	32	1

If signals are routed through the **OC-5660-UPXD** up/down/cross Converter the delays are as follows:

Input Standard	Output Standard	Delay (ms)	Delay (Frames - rounded to ½ frame)
1080i 50	1080i 50	118	3
1080i 50	720p 50	78	4
1080i 50	1080p 25	119	3
1080i 50	720p 25	119	3
720p 50	1080i 50	58	1.5
720p 50	720p 50	58	3
720p 50	1080p 25	99	5
720p 50	720p 25	79	2
1080p 25	1080i 50	78	2
1080p 25	720p 50	78	4
1080p 25	1080p 25	119	3
1080p 25	720p 25	119	3
1080i 59.94	1080i 59.94	98	3
1080i 59.94	720p 59.94	65	4
1080i 59.94	1080p 29.97	99	3
1080i 59.94	720p 29.97	99	3
720p 59.94	1080i 59.94	65	2
720p 59.94	720p 59.94	48	3
720p 59.94	1080p 29.97	49	1.5
720p 59.94	720p 29.97	82	2.5
1080p 29.97	1080i 59.94	65	2
1080p 29.97	720p 59.94	48	3
1080p 29.97	1080p 29.97	99	3
1080p 29.97	720p 29.97	99	3
1080i 60	1080i 60	98	3
1080i 60	720p 60	65	4
1080i 60	1080p 30	99	3
1080i 60	720p 30	99	3
720p 60	1080i 60	65	2
720p 60	720p 60	48	3
720p 60	1080p 30	65	2
720p 60	720p 30	82	2.5
1080p 30	1080i 60	65	2
1080p 30	720p 60	48	3
1080p 30	1080p 30	99	3
1080p 30	720p 30	99	3
1080p 24	1080p 24	124	3
1080p 24	720p 24	124	3
1080p 24	1080psF 24	82	1
1080psF 24	1080p 24	124	3

1080psF 24	720p 24	124	3
1080psF 24	1080psF 24	123	1.5
1080p 23.97	1080p 23.97	124	3
1080p 23.97	720p 23.97	124	3
1080p 23.97	1080psF 23.97	103	1
1080psF 23.97	1080p 23.97	124	3
1080psF 23.97	720p 23.97	124	3
1080psF 23.97	1080psF 23.97	123	1.5
1080i 50	625	119	3
720p 50	625	79	2
1080p 25	625	99	2.5
1080i 59.94	525	99	3
720p 59.94	525	82	2.5
1080p 29.97	525	82	2.5
625	625	119	3
525	525	65	2
625	1080i 50	78	2
625	720p 50	78	4
625	1080p 25	119	3
625	720p 25	119	3
525	1080i 59.94	65	2
525	720p 59.94	48	3
525	1080p 29.97	65	2
525	720p 29.97	99	3

Audio Processing

The module will de-embed the complete audio payload from each incoming SDI stream (4 AES groups = 8 AES = 16 audio channels). Audio is de-embedded from both input SDI signals passed to an AES audio input matrix along with 4 External AES inputs.

The type of audio (PCM, Dolby E or Audio Data) is detected by the module automatically.

The AES input matrix has 20 selectable input channels. There are 5 separate audio pathways through the frame synchronizer, each one selected according to the application and requirements for audio processing.

The audio streams can be individually delayed in various zones (see GUI section).

Pathway 1

This audio pathway is scaled 8 x AES signals wide (16 channel). The audio is fed through selectable sample rate converters (SRC's) where the audio is re-sampled, synchronized and then fed into a full audio processing stage, which includes mono gain adjustment, mute, phase inversion, silence and overload detection.

PCM Audio using this pathway will be free from any audio interference ("pops and clicks") when frames are dropped or repeated by the frame synchronizer.

> ***Note.*** *If an encoded Dolby E audio signal is detected by the module the associated SRC and the following audio processing will be switched off automatically. For asynchronous Dolby E streams you should use Audio Pathway 3 which provides Dolby E synchronizers.*

Pathway 2

This audio pathway is scaled 8 x AES signals wide (16 channels) and bypasses any sample rate conversion, therefore any of these channels are DolbyE transparent through the synchronizer. **It is assumed the audio is already synchronous** to the connected reference signal (no audio synchronization is performed by the synchronizer(s) on these audio channels).

Pathway 3 – (For DolbyE)

The PVD 5660 is transparent to any embedded or external DolbyE bit streams:

a) If the input is synchronous - then any audio pathway can be used,

b) If the input is asynchronous - Pathway 3 provides 4 Dolby E synchronizers, which synchronizes the Dolby E signal to the reference signal and automatically aligns the guard-band.

Note: *Synchronization and auto guard band alignment only works correctly if the frame rates of the video input/output matches the reference signal (see above "Reference lock).*

Note: *The Dolby Synchronizers have to be referenced to one of the video outputs or the AES audio outputs for correct guard band alignment (see also description in the GUI section below, page 67)*

Pathway 4 and Pathway 5

Each of these two pathways are 4 x AES signals wide (8 channels) and these bypass all internal audio processing and audio synchronization. These channels are simply de-embedded audio maintaining synchronization to the respective incoming SDI stream.

These channels **cannot** be re-embedded back into the output SDI signals, but can be routed to the external AES outputs using the output matrix for external processing.

Pathways 1,2 and 3 are fed into 4 independent mono audio output crossbars which provide 16 channels of audio to 4 independent output embedders, one for each of the SDI outputs. There is also a 4 x AES (8 channel) external outputs via an independent mono crossbar if required.

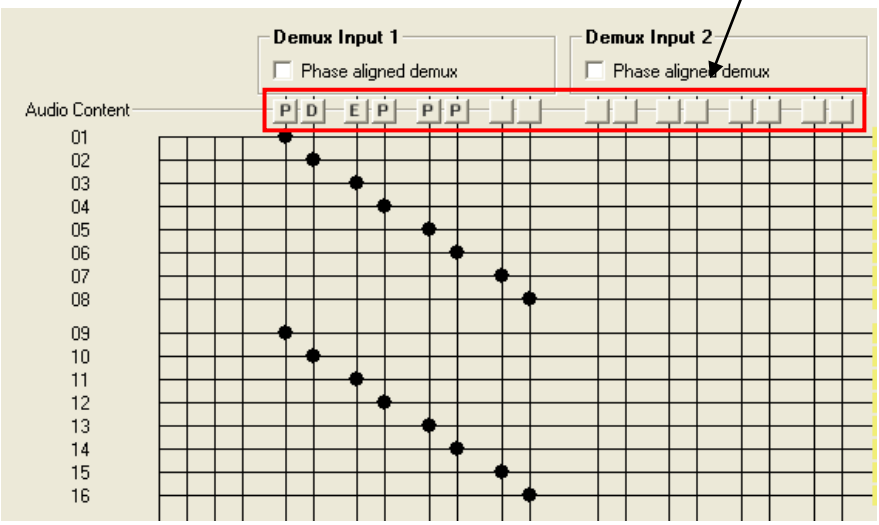
Note. *All external AES connections are isolated through transformer coupling.*

Automatic Audio Detection

Audio presence and audio format for the embedded audio on the 2 SDI inputs and the 4 x external AES inputs is automatically detected and displayed on the module GUI in the LYNX control system.

This can be seen below; the small blocks under the de-embedder indicate the audio status for each AES stream:

P = PCM Audio Detected
E = Dolby E Audio Detected
D = Digital Audio Stream (other than DolbyE) Detected
Blank = No Audio Signal Present

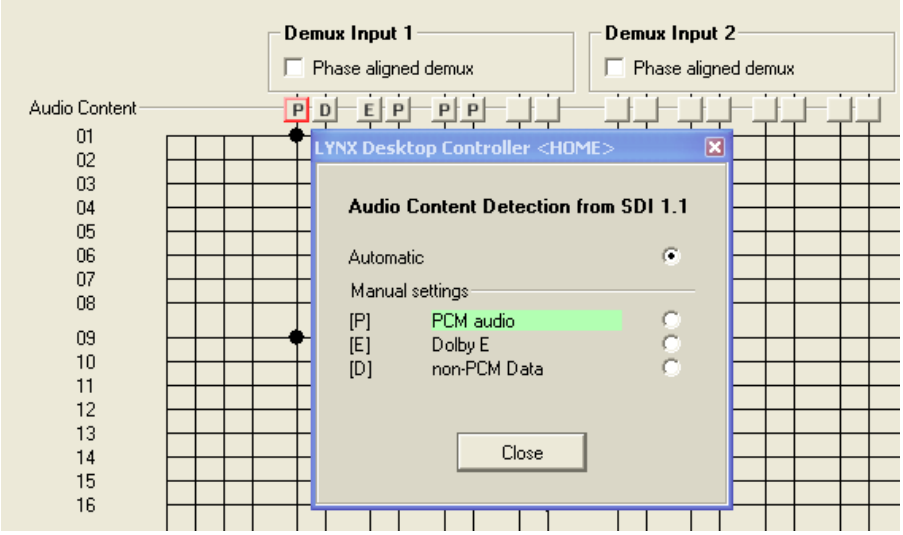


In this example you can see input 2 has no audio present, and input 1 has the following:

AES 1 = PCM Audio
AES 2 = Digital Audio Stream
AES 3 = Dolby E Audio
AES 4 = PCM Audio
AES 5 = PCM audio
AES 6 = PCM Audio
AES 7 = No Audio Present
AES 8 = No Audio Present

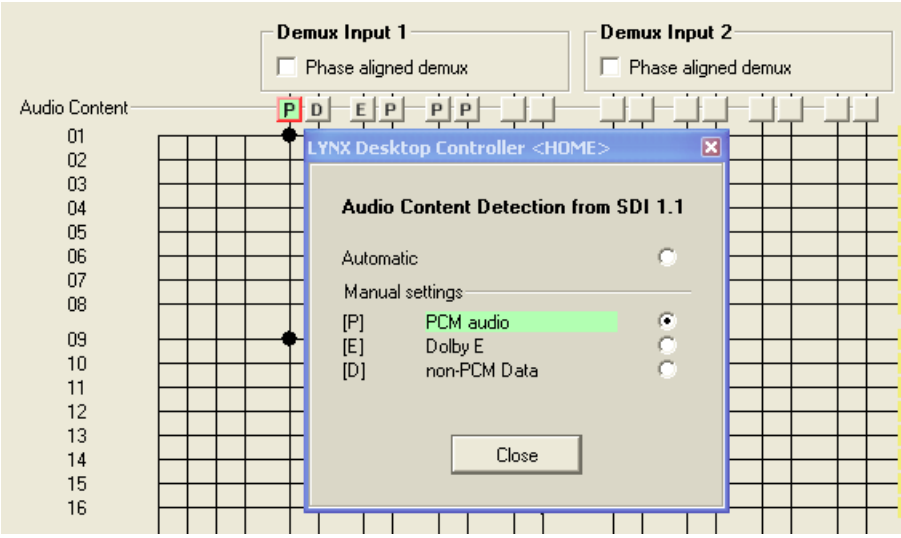
Configuring Audio Inputs

Audio inputs can be configured automatically based on the audio detected, or manually configured to be only a particular type. When an input is manually configured the system will indicate when a conflict exists between the configured setting and the detected audio on that channel by highlighting the box in yellow.
Clicking on one of the audio boxes with the mouse will bring up the audio configuration dialog for that channel, see below



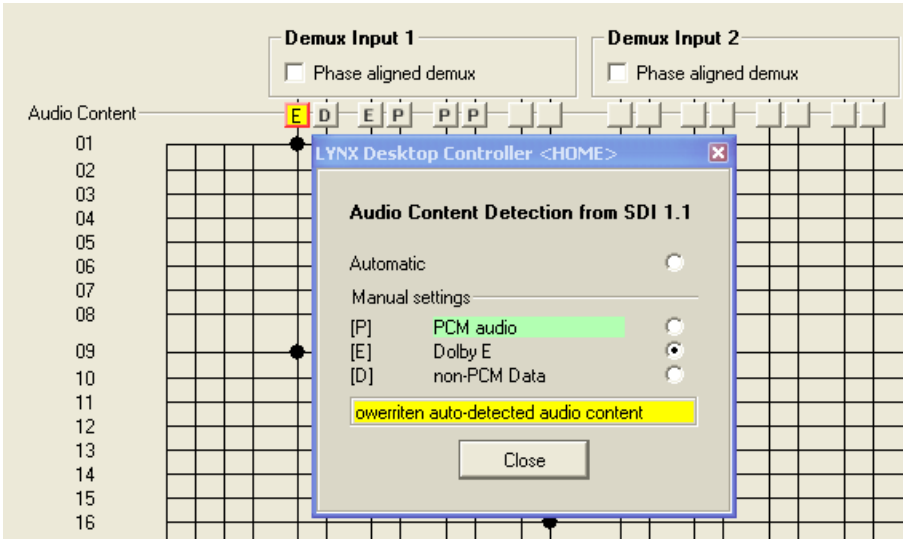
The default setting is always automatic, as seen above and for this first input you can see it has detected PCM audio.

To manually set this input simply click on the respective selection with the mouse



In this case you can see input 1 has been manually configured for PCM audio, and it is highlighted green to indicate it is a manual selection, and there is no conflict. (a box with a letter inside which is not green indicates this channel is configured for automatic detection)

If we manually force this input to DolbyE, this will cause a conflict as PCM audio is present. See below:



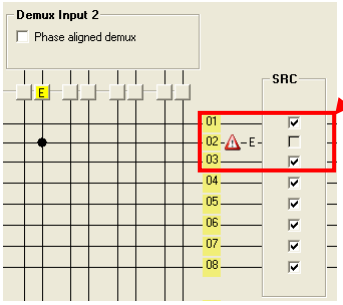
Here you can see the conflict is flagged by turning the box yellow. This is indicating the channel is manually preset for Dolby E, but the audio format is in conflict with this setting, in this case PCM audio. **Note.** *Even though there is a conflict the actual audio content is passed through the system – i.e. it is not blocked.*

Maintaining DolbyE Transparency

The PVD 5660 can process and synchronize DolbyE signals transparently, but some care needs to be taken as to the routing of the DolbyE signals (or any compressed audio bit stream) through the module. To help maintain transparency the module will automatically bypass any processing stages which might corrupt this signal, and also provide a warning indication in the GUI (indicating there is a possible problem with the specified routing of this signal in the module)

For example, if DolbyE audio is routed through any of the inputs in audio Pathway 1 there are three areas of concern. b) The sample rate converters, b) the audio processing stage c) Synchronization and DolbyE guard band timing.

The module will automatically disable the input audio delay, the sample rate converter and bypass the audio processing for this channel in the Audio Processing amp (controls will be greyed out) – so in this case the DolbyE signal will be passed transparently and is ready for re-embedding into the outputs (or passing to an external output). **However** audio Pathway 1 does not have any DolbyE synchronization capability, so the DolbyE audio will not be synchronized and also the guard-band timing could be incorrect. To indicate this conflict a small warning symbol is inserted into the audio line in the control system GUI. See below:



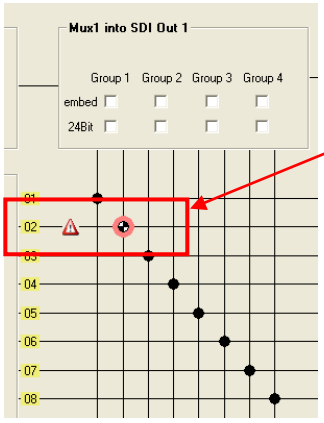
Here you can see DolbyE from input 2 has been routed into audio Pathway 1, channel 2

The module has inserted the warning symbol. **Note**. *The module has automatically greyed out the sample rate converter and has also disabled the downstream audio processing (not seen here)*

A better choice for signal this DolbyE signals is Pathway 3, as this is designed for DolbyE and includes 4 x DolbyE synchronizers and will always maintain the correct guard-band timing.

Note: *The Dolby Synchronizers have to be referenced to one of the outputs for correct guard band alignment (see also description in the GUI section below, page 67)*

Another area of concern for DolbyE or compressed audio streams is the mono audio output crossbars. These should not be changed from the default setting for these types of signals. The Module will also provide a visual warning if any of the mono cross points are in conflict.



Here you can see the highlighted cross-point has been manually changed from its default settings. The warning symbol clearly indicates there is a conflict with this cross-point setting for the audio signal present.

Note. *For information on how to configure and switch mono cross-points, please refer to the GUI section of the manual*

The PVD 5660 has some very powerful audio capabilities, and enables the handling of compressed DolbyE signals and any other compressed audio bit stream transparently if a little attention is paid to the internal signal routing and application of the module.

The alternative is to decode the audio and then process all audio as discreet PCM audio channels, finally re-encoding the audio before re-embedding. If no audio manipulation is required within the compressed bit stream (i.e. adjusting audio levels, swapping channels etc) then there is no real requirement to decode and re-encode the audio. Aside from the possible quality loss compounding from multiple decode and encode cycles this would add considerable cost to the solution and significantly increase module size.

Note: *The Dolby Synchronizers have to be referenced to one of the video outputs or the AES audio outputs for correct guard band alignment (see also description in the GUI section below, page 67)*

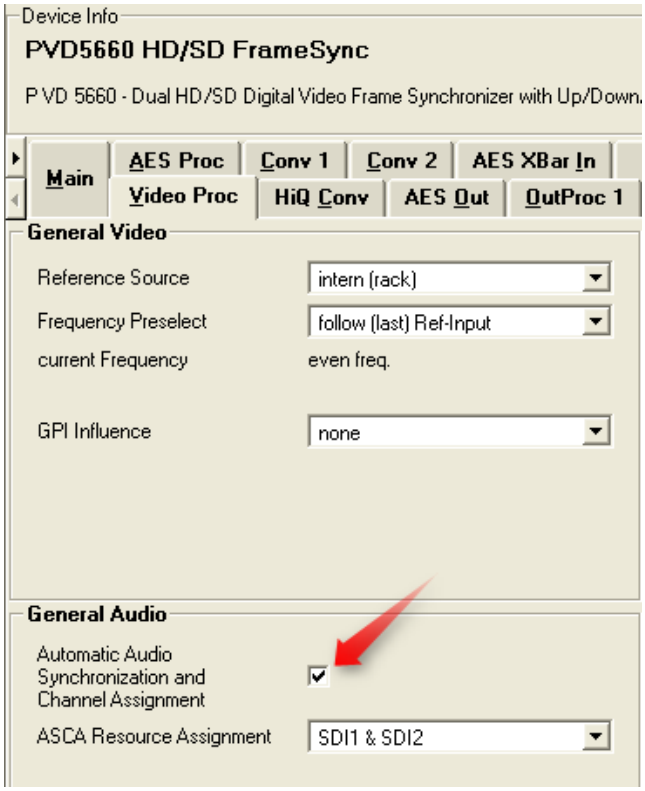
Automatic Audio Synchronization & Channel Assignment (ASCA)

Introduction

The PVD5660 Frame Synchronizer provide comprehensive audio routing capabilities; providing a separate AES input crossbar and also individual mono crossbars for each output channel. While this provides the greatest level of flexibility it can also be cumbersome for basic applications which just need the audio passed through the system transparently (The same embedded audio configuration on the input is required on the synchronized output).

The new Automatic Audio Synchronization and Channel Assignment (ASCA) function has been introduced to address this, and once enabled will ensure the incoming embedded audio streams are synchronized and then routed to the appropriate output. (i.e. audio is embedded into the same group of the same video program).

> **Note.** *External AES inputs are not supported while the ASCA function is enabled The ASCA function is by default OFF which required manual configuration of the audio crossbars*



The ASCA function is enabled and configured on the video proc tab using the LYNX Desktop Controller (control system)

Working Principle

Depending on the type of audio content (PCM, DolbyE, other data ...), different synchronization methods, and therefore different internal audio pathways have to be used for each audio input stream. The ASCA function will automatically select the appropriate audio pathway through the module by automatically configuring the various internal audio crossbars based on the type of audio signal.

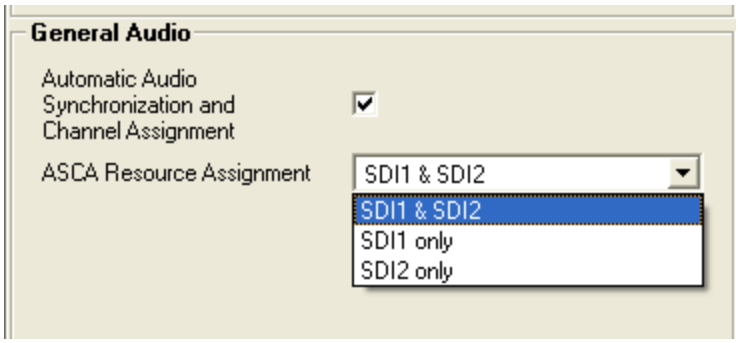
Limited Sync Resources

The synchronization resources are limited on each module. There are a total of 8 sample rate converters (SRC) and 4 DolbyE frame-synchronizers (DE-FS) available. In the case of a dual-channel module with the second input option, the user has to specify how these synchronization resources are assigned to the input SDI signals. The available choices are the following:

1. **SDI1 + SDI2** *(this is the default)*
   4 SRCs and 2 DE-FSs are available to synchronize the audio-content of SDI1
   4 SRCs and 2 DE-FSs are available to synchronize the audio-content of SDI2

2. **SDI1 only**
   All 8 SRCs and 4 DE-FSs are available to synchronize the audio-content of SDI1
   Audio-content of SDI2 cannot be synchronized and can only be passed through as is (embedded)

3. **SDI2 only**
   Audio-content of SDI1 cannot be synchronized and can only be passed through as is (embedded)
   All 8 SRCs and 4 DE-FSs are available to synchronize the audio-content of SDI2

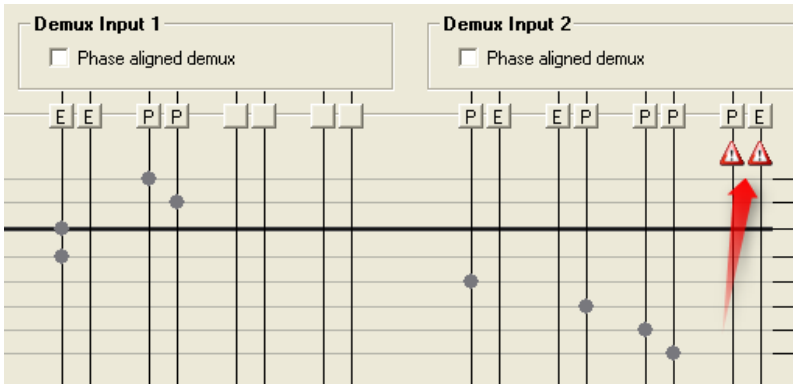


Note:

- *As mentioned above, user configuration is only needed in products with two inputs and when both of these inputs are active. If only one input is used, the "SDI1 only" mode is automatically active.*

- *In any of the non-shared modes ("SDI1 only" or "SDI2 only"), the other SDI input can only be used with signals that are either:*
  *(a) Synchronous -**OR**-*
  (b) Do not contain any embedded audio of any format.

In the event that the available synchronization resources are exceeded, the remaining audio content will be passed through **un-synchronized** and a warning will be visible in the control system GUI. This situation can occur even in a single channel module, and independently of the above user decisions on resource allocation per channel. For example, this situation can occur if there are more than 4 DolbyE streams embedded in the incoming SDI signal, or when a dual-channel device is operated in "SDI1 + SDI2" mode and more than 4 'AES' streams containing PCM-audio are embedded in one of the incoming SDI signals.



The available resources (per SDI channel) are applied to the embedded audio streams in the following order of priority (if one of the audio-streams is not present, it will not be assigned any resources):

1. Audio streams de-embedded from group 1
2. Audio streams de-embedded from group 2
3. Audio streams de-embedded from group 3
4. Audio streams de-embedded from group 4
5. In the event of unavailable synchronization resources, a warning will be issued and the remaining audio-channels will be process un-synchronized. All audio signals will be delivered on the output in any case. So the limitation applies only in an asynchronous environment.

Limitations:

1. Audio Disturbances

Whenever the ASCA function is re-configuring the audio-channels, the configuration process will possibly generate audible disturbances in some of the audio output channels (embedded or AES) of the same video program. Such re-configuration will be triggered by any change of the appropriate input configuration (video, embedded audio). Therefore this function is recommended to be used in environments, in which the incoming signal configuration does not change while a programming stream is being processed. I.e. it can be used for automatic pre-setup only.

2. Flexibility: Crossbars and processing

Using the ASCA function imposes the following limitations to the audio infrastructure:

- Internal audio processing (mute, gain, invert, …) is disabled and set to neutral
- Takes full control over all internal audio-crossbars (input and output), except the crossbar configuring the external AES output channel assignment.

Accordingly, the effected audio-crossbars and audio processing parameters will be grayed out and set to read-only in the control system.

3. Persistence of user settings

After turning the ASCA function ON, audio-infrastructure settings (crossbars, SRCs, Embedders) are modified by an automatic process. When the ASCA function is then turned OFF again, previous settings are *not* automatically restored. As a consequence, turning the ASCA ON and OFF can result in a modified audio-infrastructure (crossbars, processing).

4. External AES input not usable

Turning the ASCA function ON will allocate all available audio-synchronization resources to the signals de-embedded from video inputs SDI1 and SDI2. The external AES inputs cannot be used at all.

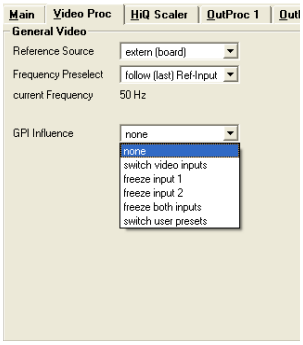
On the other hand, the external AES outputs are not controlled by ASCA. I.e. the "AES output" crossbar is still active (not grayed out). However, the automatic ASCA process can re-assign individual audio streams to different internal audio channels. So, if an external AES output is connected to a particular internal audio stream, the content of that stream can change spontaneously, because ASCA has modified the AES input crossbar, following a change of the audio in the input signal.

5. DolbyE Frame synchronizer timing assignment

The ASCA function will use the available DE-FS channels to provide frame-synchronization and guard-band alignment of the DolbyE signal. If the same video signal is assigned to multiple video outputs (using the video crossbar on the main page of the GUI), and if those video outputs use a different timing offset (relative to the current sync. input), then the correct audio/video timing of the DolbyE stream can only be guaranteed for the first of those SDI outputs. For details refer to section "Maintaining DolbyE Transparency" / "Pathway 3 – Dolby E" of the product user manual.

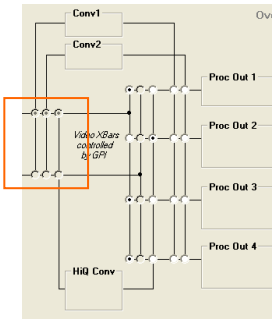
GPI Function

The GPI input (**G**eneral **P**urpose **I**nterface) which is a switch input function (contact closure) can be used to perform a number of functions. The influence of this input can be set by the user using the control system on the Video Proc Tab or User Preset Tab..



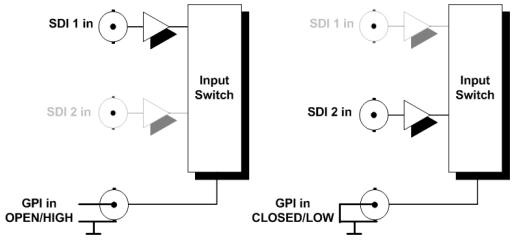
Switch Inputs

With the GPI “Switch Video Inputs” mode selected the internal video cross bars are not accessible through the control system anymore. (Greyed out) see below:



With the GPI contact open all converters are switched to Input 1, with GPI contact closed both the converters are switched to Input 2.

The cross bar points, (which allow switching the four video outputs to the internal converter outputs) retain their settings, and the cross bar points which allow the switching the original inputs to the four outputs are switched to Input 1 with GPI open, and to Input 2 with GPI closed.



The settings of the audio crossbar for Deembedder 1, which deembeds the audio from SDI 1, are also switched to Deembedder 2.

Freeze input with GPI

If this mode of the GPI influence is selected then the following functions will be performed:

- With GPI open the module processes all input signals as usual
- With GPI closed the inputs will be frozen (volatile freeze, i.e. frozen frame is not retained through power cycle)

The influence can also be configured to freeze input 1 only, freeze Input 2 only (if 2nd input option is installed) or freeze both inputs.

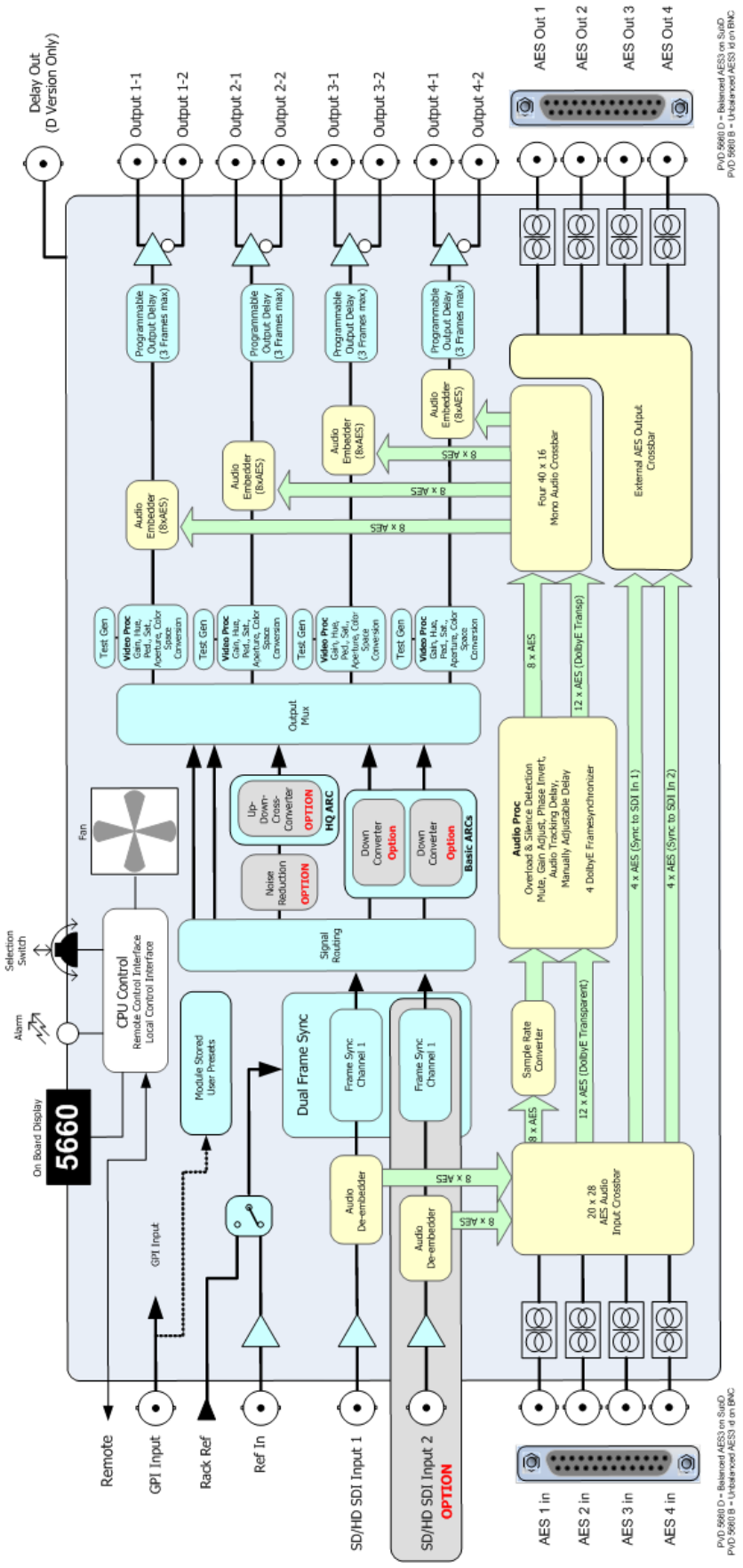
In the case of an activated freeze on one or both inputs the module processing performs all functions on the frozen frame(s).

User Presets – GPI Switch

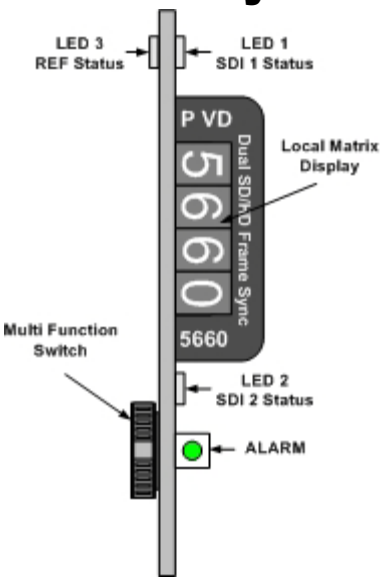
User Presets allow the user to store 7 additional sets of module settings (snapshots) in addition to the current settings in module flash RAM. The GPI can then be configured to toggle between any 2 of the 8 stored presets by selecting "*switch user presets*" as the GPI influence setting. (Refer to the *User Settings* section in the GUI part of this manual for more details, page 73)

Functional Diagram

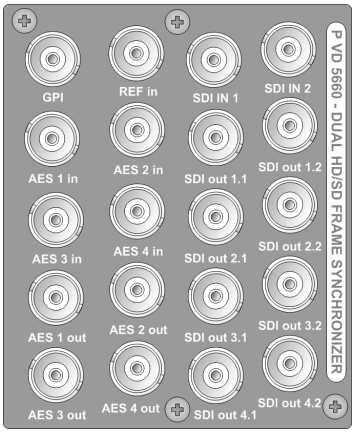
A functional diagram of the PVD 5660 is shown on the next page.

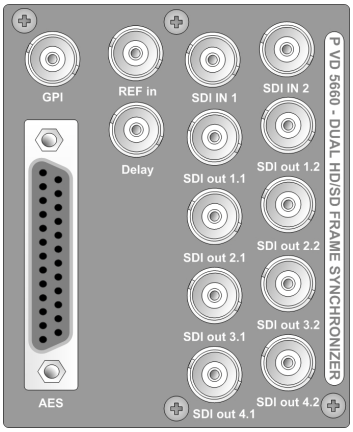

Delay Out
(D Version Only)
Output 1-1
Output 1-2
Output 2-1
Output 2-2
Output 3-1
Output 3-2
Output 4-1
Output 4-2
AES Out 1
AES Out 2
AES Out 3
AES Out 4
PVD 5660 D = Balanced AES3 on SubD
PVD 5660 B = Unbalanced AES3 id on BNC
Programmable Output Delay (3 Frames max)
Audio Embedder (8xAES)
8 x AES
Four 40 x 16 Mono Audio Crossbar
External AES Output Crossbar
Test Gen
Video Proc Gain, Hue, Ped., Sat., Aperture, Color Space Conversion
Output Mux
8 x AES
12 x AES (DolbyE Transp)
Up-Down-Cross-Converter OPTION
HQ ARC
Noise Reduction OPTION
Down Converter Option
Basic ARCs
Audio Proc
Overload & Silence Detection
Mute, Gain Adjust, Phase Invert,
Audio Tracking Delay,
Manually Adjustable Delay
4 DolbyE Framesynchronizer
4 x AES (Sync to SDI In 1)
4 x AES (Sync to SDI In 2)
Fan
Selection Switch
Alarm
On Board Display
5660
CPU Control
Remote Control Interface
Local Control Interface
Signal Routing
Module Stored User Presets
Dual Frame Sync
Frame Sync Channel 1
Audio De-embedder
8 x AES
Sample Rate Converter
12 x AES (DolbyE Transparent)
20 x 28 AES Audio Input Crossbar
GPI Input
Remote
GPI Input
Rack Ref
Ref In
SD/HD SDI Input 1
SD/HD SDI Input 2
OPTION
AES 1 in
AES 2 in
AES 3 in
AES 4 in
PVD 5660 D = Balanced AES3 on SubD
PVD 5660 B = Unbalanced AES3 id on BNC

Module Layout



Module Front Panel

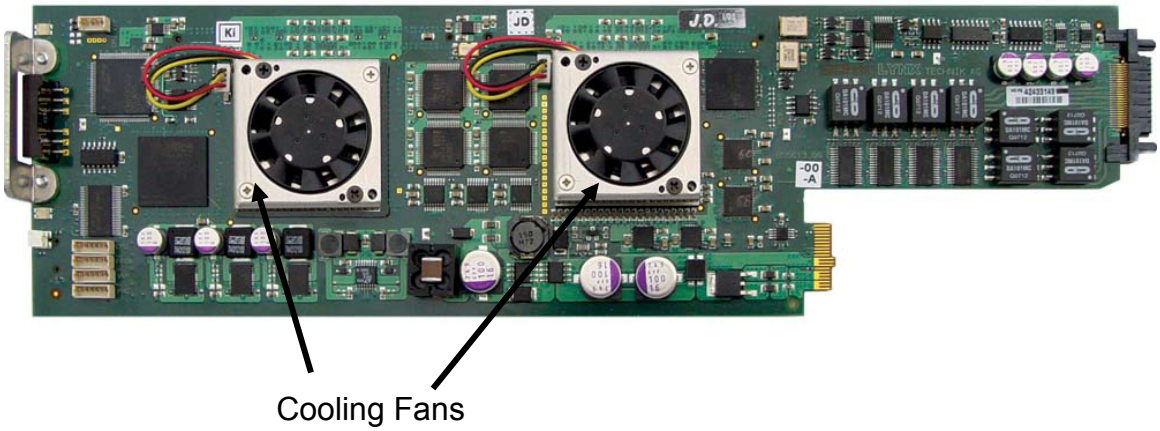




Two versions of the PVD 5660 are available:

PVD 5660 B = BNC connectors for unbalanced AES3id
PVD 5600 D = SubD connector for balanced AES3

Module Rear Termination Panels



Note. *Cooling fan operation is monitored and alarmed with the module alarm LED and also within the LYNX control system.*

Connections

Video

The PVD 5660 uses standard 75 Ohm BNC connectors. We recommend the use of high quality video cable for digital video connections to reduce the risk of errors due to excessive cable attenuation. Max cable lengths the module will support are shown below.

SDTV = 250m Belden 8281 (270Mbits/s)
HDTV = 140m Belden 1694A (1.4Gbits/s)

> ***Note.*** *Due to the compact design of the connection plate it will be necessary to use a connection tool to secure the BNC video connectors.*

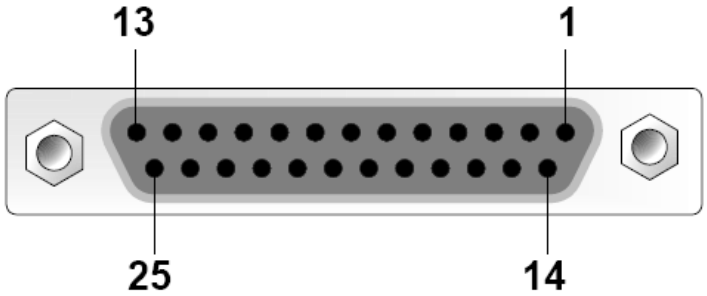
External Audio (AES)

The module provides for both Unbalanced (AES3id) and Balanced (AES3) external audio connections.

The **PVD 5660 B** version provides BNC connections for unbalanced AES3id
The **PVD 5660 D** version provides a SubD connector for balanced AES3

Connections for the SubD connector are provided below

Pin Number	Connection	Pin Number	Connection
1	AES 4 out +	14	AES 4 out -
2	AES 4 out GND	15	AES 3 out +
3	AES 3 out -	16	AES 3 out GND
4	AES 2 out +	17	AES 2 out -
5	AES 2 out GND	18	AES 1 out +
6	AES 1 out -	19	AES 1 out GND
7	AES 4 in +	20	AES 4 in -
8	AES 4 in GND	21	AES 3 in +
9	AES 3 in -	22	AES 3 in GND
10	AES 2 in +	23	AES 2 in -
11	AES 2 in GND	24	AES 1 in +
12	AES 1 in -	25	AES 1 in GND
13	n.c.		



View looking INTO connector as seen on module

We recommend you use high quality screened (twisted pair) cable for the balanced audio connections.

Installation

If this module was supplied as part of a system it is already installed in the rack enclosure. If the module was supplied as a field upgrade please follow the installation procedure below.

***NOTE** Observe static precautions when handling card. Please see ESD warnings on Page 7.*

This module has a double width rear connection panel, meaning it will occupy two slots of a standard Series 5000 Card Rack. This is to accommodate the additional connections needed for this module and to also provide adequate space for cooling in the rack. Up to five P VD 5660 modules can be accommodated in a single Series 5000 rack frame.

> **NOTE.** *When using this module the **R FR 5011 or R FR 5012 Fan Front Rack Frame** should be used which provides additional airflow into the rack. If you plan to install this module into empty slots in an existing rack with no fan front cover - then please purchase the **R FR 5001 Fan Front update kit.***

Each Card Module is supplied with a rear connection panel and mounting screws. Please follow the procedure below for the installation of the card module into the Series 5000 Card Frame.

We recommend you power the rack down before installing any additional modules into an existing card frame.

1. Select a free two slot space in the card frame where the CardModule will be located.

2. Remove the blank connection panels from the rear of the rack (if fitted)

3. Install the rear connection panel using the screws supplied. Do not tighten the screws fully

4. Slide the card module into the card frame and carefully check the CardModule connects to the rear connection plate. The card should fit easily and should not require excessive force to insert - if you feel any resistance, there could be something wrong with the rear connection panel location. **Do not** try and force the connection this may damage the connectors. Remove the rear connection panel and check alignment with the CardModule.

5. Insert and remove the CardModule a few times to ensure correct alignment and then tighten the two screws to secure the rear connection plate.

6. Power up the rack and check the module LED's and matrix display illuminate. Check the module is automatically logged into the control system device tree. *(It may take a few seconds for the control system to "discover" the new module)*

> ***NOTE.** The use of the optional control system is **mandatory** for the control and setup of this module. If you do not have the control system, then please contact your LYNX representative for details on how to upgrade your installation with the LYNX control system.*

Firmware Options

The basic module is a single channel frame synchronizer and SDTV ARC with full audio support, providing four user mapped outputs. With the addition of the following firmware options the performance and features of the module can be greatly enhanced and customized to meet a specific application.

> ***Note.*** *Firmware options can be added at any time by simply purchasing and installing a license code string. No hardware or firmware modifications are needed.*

For information on how to install a licensed option please refer to the GUI section of this manual.

Second Input Option (OC-5660-SCND)

The addition of this option will enable the second input and provide a second channel of frame synchronization. This also includes a 16 channel de-embedder with 16 additional inputs into the integrated AES input crossbar.

It is possible to switch seamlessly between the two inputs (clean switch) which can be configured to trigger via GPI input or can be switched via the control system.

> ***Note:*** *Both frame synchronizers are connected to the single reference input used for the module*

Down Conversion Option (OC-5660-DWN)

With the addition of this option, basic HDTV to SDTV down conversion capability is added to the module (2 instances are required to provide two internal channels of down conversion). These converter(s) are individual internal resources which can be routed to any input signal and any of the four available outputs. Modes of operation are described below.

Letterbox

This takes the 16:9 aspect ratio of the input HD signal and fits it into the 4:3 SD aspect ratio screen with black bars at the top and bottom of the image.

Center Cut

This mode cuts the center portion of the 16:9 input signal and fills the 4:3 SD aspect ratio screen.

Stretch to Fill

This mode takes the 16:9 input signal and distorts (vertically stretches) the image to fit the available 4:3 SD aspect ratio space.

16:9 HDTV Source

4:3 Center Cut

4:3 Letterbox

4:3 Stretch to fill

Up/Down/Cross Conv. Option (OC-5660-UPXD)

The addition of this option adds a single channel of high quality up, down and cross conversion to the module (which can be used in addition to the basic down conversion options if installed). This is an internal resource which can be routed to any input signal and mapped to any (or all) of the four available outputs. Modes of operation are described below.

> ***Note :*** *Operation mode is switchable i.e. Up Conversion* ***OR*** *Down Conversion* ***OR*** *Cross Conversion.*

Down conversion

Down conversion modes are as described previously for the basic down conversion option.

This converter also adds a 14:9 conversion

Up Conversion

The UP converter will convert the connected SDTV input standard to the selected HD Standard within the same or half the frame rate. See below

525 / 59.94Hz Input Signal Converted to 1080i / 59.94Hz or 720P / 59.94Hz
625 / 50Hz Input Signal Converted to 1080i / 50Hz or 720P / 50Hz

Modes of operation are as follows:

Center Cut

This mode cuts the horizontal center portion of the 4:3 SD input signal and fills the 16:9 HD aspect ratio image area. (top and bottom of image are cropped)

PillarBox

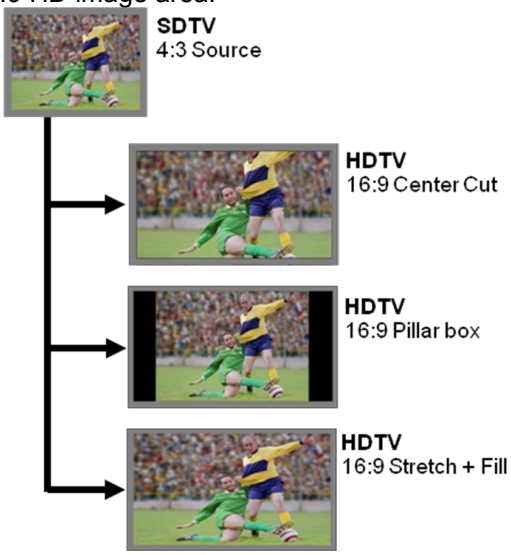
This takes the 4:3 SD aspect ratio of the input signal and fits it vertically into the 16:9 HD image area with black bars at the left and right of the image.

Stretch to Fill

This mode takes the 4:3 SD input signal and distorts (horizontally stretches) the image to fit the available 16:9 HD image area.

14:9 Conversion

This mode takes the 4:3 SD input signal and distorts (horizontally stretches) the image to fit the available 14:9 HD image area.



Cross Conversion

When used in cross conversion mode the module will cross convert the video signal between formats within the same or half the frame rate. Please refer to the table below for supported conversion modes.

	525 59.94Hz	625 / 50Hz	1080i / 50Hz	1080i / 59.94Hz	1080i / 60Hz	1080p / 23.98Hz	1080p / 24Hz	1080p / 25Hz	1080p / 29.97Hz	1080p / 30Hz	1080psf / 23.98Hz	1080psf / 24Hz	1080psf / 25Hz	720p / 23.98Hz	720p / 24Hz	720p / 25Hz	720p / 29.97Hz	720p / 30Hz	720p / 50Hz	720p / 59.94Hz	720p / 60Hz
525 59.94Hz				Y					Y								Y			Y	
625 / 50Hz			Y					Y					Y			Y			Y		
1080i / 50Hz		Y						Y					Y			Y			Y		
1080i / 59.94Hz	Y								Y								Y			Y	
1080i / 60Hz										Y											Y
1080p / 23.98Hz											Y			Y							
1080p / 24Hz												Y			Y						
1080p / 25Hz		Y	Y										Y			Y			Y		
1080p / 29.97Hz	Y			Y													Y			Y	
1080p / 30Hz					Y													Y			Y
1080psf / 23.98Hz						Y								Y							
1080psf / 24Hz							Y								Y						
1080psf / 25Hz		Y	Y					Y								Y			Y		
720p / 23.98Hz						Y					Y										
720p / 24Hz							Y					Y									
720p / 25Hz		Y	Y					Y					Y						Y		
720p / 29.97Hz	Y			Y					Y											Y	
720p / 30Hz				Y						Y											Y
720p / 50Hz		Y	Y					Y					Y			Y					
720p / 59.94Hz	Y			Y					Y								Y				
720p / 60Hz					Y					Y								Y			

Green (Y) = Supported mode, White (empty) = Not supported mode, Grey = Not applicable

Image size and Positioning

This option also provides the ability to manually adjust the image size and position of the converted output. For more information on the controls and use of this feature please refer to the GUI section of this manual for more details.

Note: The converters can be automatically controlled by AFD (Active Format Description), WSS (Wide Screen Signaling) and VI (Video Index). Please refer to the GUI section of this manual for more information of the controls provided and how to use them.

Color Space Conversion

The conversion options also provide integrated color space conversion capability which will automatically compensate for the conversion of the wider 709 HD color space into the more narrow 601 SDTV color space or vice versa ensuring legal color reproduction.

> **NOTE.** *Color space conversion can be bypassed, or set to process only the chrominance part of the signal if desired.*
>
> **Note:** *If this option (OC_5660_UPXD) is activated the detail Enhancement is active (please see page 37)*

Noise Reduction (optional: OC-5660-NR)

The module provides optional Noise Reduction functionality for one channel:

The adaptive noise reduction function processes the input data in either progressive or interlaced format. Application of noise reduction to noisy interlaced signals can optimize the de-interlacer performance.

General Noise Reduction

General noise reduction comprises of both adaptive 2D and 3D noise reduction. 3D noise reduction corrects for temporal and spatial noise; and 2D noise reduction corrects spatial. 3D noise reduction is applied to any interlaced or progressive signal with a pixel rate less than or equal to 75Mp/s. 2D noise reduction is applied to any interlaced or progressive signal. The selection of 2D or 3D noise reduction processing is automatically controlled by the firmware in accordance with the video signal being processed.

Block Artifact Reduction

Block Artifact Reduction (BAR) locates and reduces block edges produced by DCT based compression processing. BAR can be applied to any interlaced or progressive input signal.

Mosquito Noise Reduction

Mosquito Noise Reduction (MNR) dynamically adapts to image content, effectively reducing mosquito artifacts around sharp edges in DCT based compression. It can be applied to any interlaced or progressive signal.

Detail Enhancement (Sharpness and Texture)

The detail enhancement function provides both sharpness and texture enhancement, realized by adaptive horizontal, vertical and diagonal large edge and small edge enhancement processes. Overshoot / undershoot control is provided to minimize ringing on the enhanced edges. In addition, noise rejection is provided to minimize the amount of enhancement applied to the noisy areas of the image.

For ease of use the various controls are combined into two parameters: Level and Threshold:

- **Level:** controls the level of the horizontal, vertical as well as the diagonal high pass filtered picture content, which will be added to the original signal again, i.e. the gain of the high frequency content in the signal.

- **Threshold**: This parameter controls the level of signal which is passed through for level control, i.e. all amplitudes in the signal below this threshold will not be used for the detail enhancement.

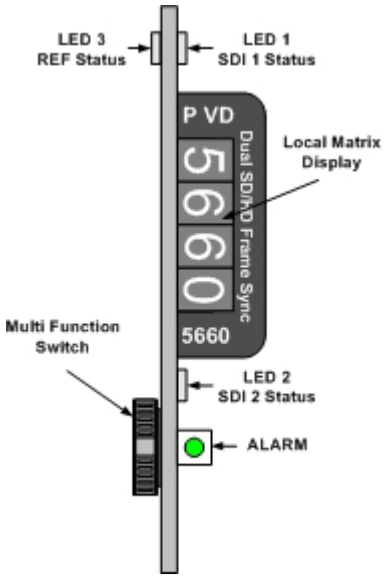
Note: *Detail Enhancement is also active if the option OC_5660_UPXD (HQ Up/Down/Cross Converter is activated*

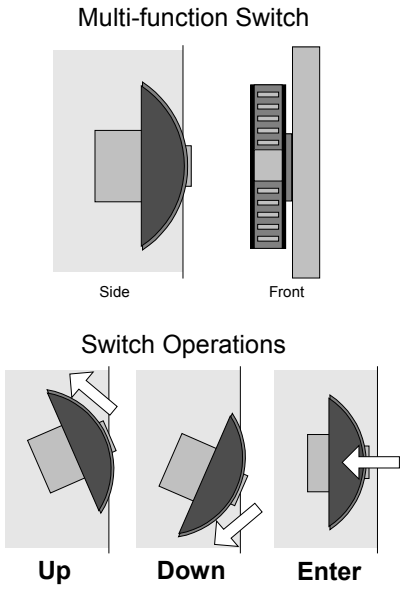
Settings and Control

The P VD 5660 module has an integrated micro-controller, which enables the module to be configured and controlled locally using the multifunction switch and 4 character dot matrix display, or from remote using a GUI interface when using one of the optional controllers and control software.

NOTE. *This module is extremely compact and flexible with hundreds of possible user settings. It is not practical to make all these settings available on the local dot matrix display. The use of the control system is **mandatory** to access the vast array of settings possible. Please refer to the GUI section of this manual for details on the control provided. Some rudimentary module settings are possible via the local controls, which are detailed below.*

Once set, all settings are automatically saved in non-volatile internal memory. (Flash RAM) The module will always recall the last used settings.





Multi Function Switch

The CardModule is equipped with a multi-function switch located on the front bottom edge of the card. (See above)

Using the Local Display Menus

Making local adjustments to the module is done using the multifunction switch and the integrated 4-character dot matrix display. The menu system is layered, and navigation through the system is done using the **UP** and **DOWN** functions of the switch. **ENTER** is used to move between menu levels and also enter a selection.

Switch Function	Operation
UP	Move UP within a level
DOWN	Move down within a level
ENTER	Change levels / Make selection

Menu Structure

The Menu structure is defined in the next table, and can be used to help navigating through the menu system.

ENTER moves between levels

UP/DOWN moves between items within the level

When a new setting is entered the system will jump back one level in the menu system.

- The “back” selection in the menu structure will take you back one level when selected.
- When an item is selected which has several setting possibilities the first value displayed will be the value currently stored in the system. The order of the available settings for any menu item in the table supplied does not represent the order the settings will actually be displayed.
- If left unattended, the menu will default to the root display after a short timeout.

LEVEL 1	LEVEL 2	LEVEL 3	Notes
P VD 5660			***Root Display***
	REF		*Reference Selection*
		EXT	*Reference taken from module rear connection panel*
		INT	*Reference taken from common rack reference*
		back	
	FPS		***Output frame rate selection***
		ODD	*All outputs jammed to 59.94Hz, 23.98 Hz or 29,97 Hz frequency frame rate**
		EVEN	*All outputs jammed to 50Hz, 24 Hz, 25, 30 Hz or 60 Hz frequency frame rate**
		AUTO	*Output frame rate is derived from connected reference (default)*
		back	
	RSET		***Reset Factory Defaults***
		NO	
		YES	*Reset factory defaults*
		back	
	back		

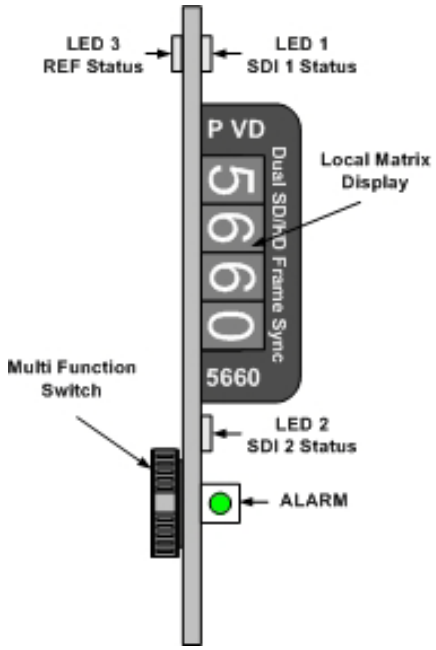
** This is for facilities which operate in a single fixed format and wish to maintain this constant output frame rate at all times (regardless of the connected reference signal, or any disturbance to the connected reference signal). This will prevent the output frame rate and format automatically “tracking” the connected reference standard should this change. The output video signal will maintain the “jammed” to the video frame rate but the video will be disturbed if the input reference signal changes.*

LED Status Indicators

The P VD 5660 module has LED indicators that serve as alarm and status indication for the module. Function is described below.

SDI 1 Status LED 1

LED Color	Indication
Green	SDI 1 Present and OK
Yellow	SDI 1 Frame Rate Mismatch *(Mismatch between the fixed output frame rate and the SDI input. Conversion taking place)*
Red	No SDI 1 Signal Connected



SDI 2 Status LED 2

LED Color	Indication
Green	SDI 2 Present and OK
Yellow	SDI 2 Frame Rate Mismatch *(Mismatch between the fixed output frame rate and the SDI input. Conversion taking place)*
Red	No SDI 2 Signal Connected

Ref Status LED 3

LED Color	Indication
Green	Reference Present
Yellow	Reference Present, but not used *(Module is set to free run with no lock to external reference)*
Red	Reference not present – but required (Module is set to “lock to reference”)

ALARM LED

LED Color	Indication
Green	Normal Operation
Yellow	Problem with one of the SDI inputs
Red	Problem with both SDI inputs
Red Flashing	Cooling Fan Failure

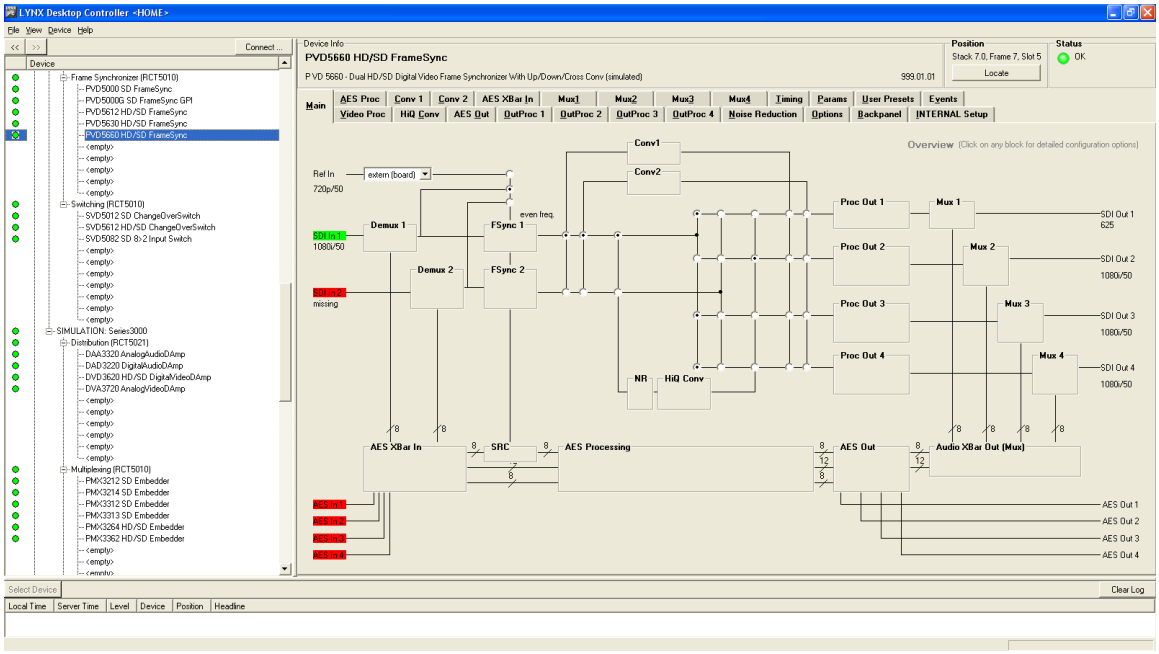
Note. *The Alarm LED can be seen with the rack front cover fitted*

Control System GUI

All LYNX CardModules support a computer interface which allows setting the modules parameters using a simple GUI interface. Access to all standard features *and in some cases* extended features is possible using this interface. The complex nature and extensive user settings provided on the PVD 5660 **requires** the use of the control system.

> ***Note.*** *Any settings made using the control system overrides any local settings made on the module. All settings are stored in internal flash ram and will survive power cycles and long term storage.*

The following GUI screenshots and descriptions shown below describe the settings and adjustments possible for the PVD 5660 CardModule.



The above screenshot shows the complete module GUI. The Device info area contains information about the module including name and firmware revision. If used as part of a larger system (using the LYNX central control system) the modules position and physical location is displayed above the “locate” button.

> ***Note.*** *The Locate function is a tool used to quickly identify a module in larger systems. Selecting “locate” will flash the module alarm LED yellow. (This does not effect module operation)*

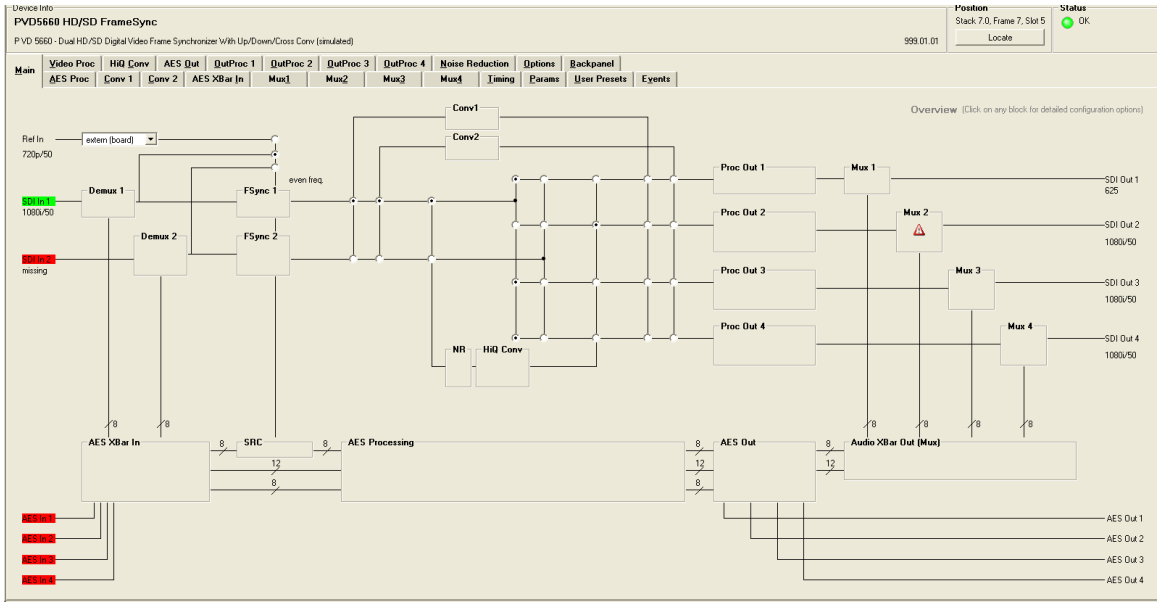
The first screen displayed when the module is selected is the ***Main Tab*** this is a graphical representation of the modules overall function and signal flow (left to right). Clicking on the processing boxes will link to other GUI screens with more controls for these specific functions.

The area at the bottom of the screen is the error log. Any fault condition (or event) will be time stamped and entered into the log.

There are a number of “Tabs” along the top of the screen which splits up the module settings into a number of logical displays. The various GUI screens and primary functions are described below.

Main Tab

This screen is the main interface and is presented first when the module is displayed in the GUI. The layout replicates module “block” functions and signal flow from left to right.



The primary purpose of this screen is to show the overall signal flow through the module and allow easy navigation to other areas. Input standards and formats are auto detected and displayed in the GUI. Parameters will be annunciated in different colors to show status (green = good, red = problem, yellow = caution etc).

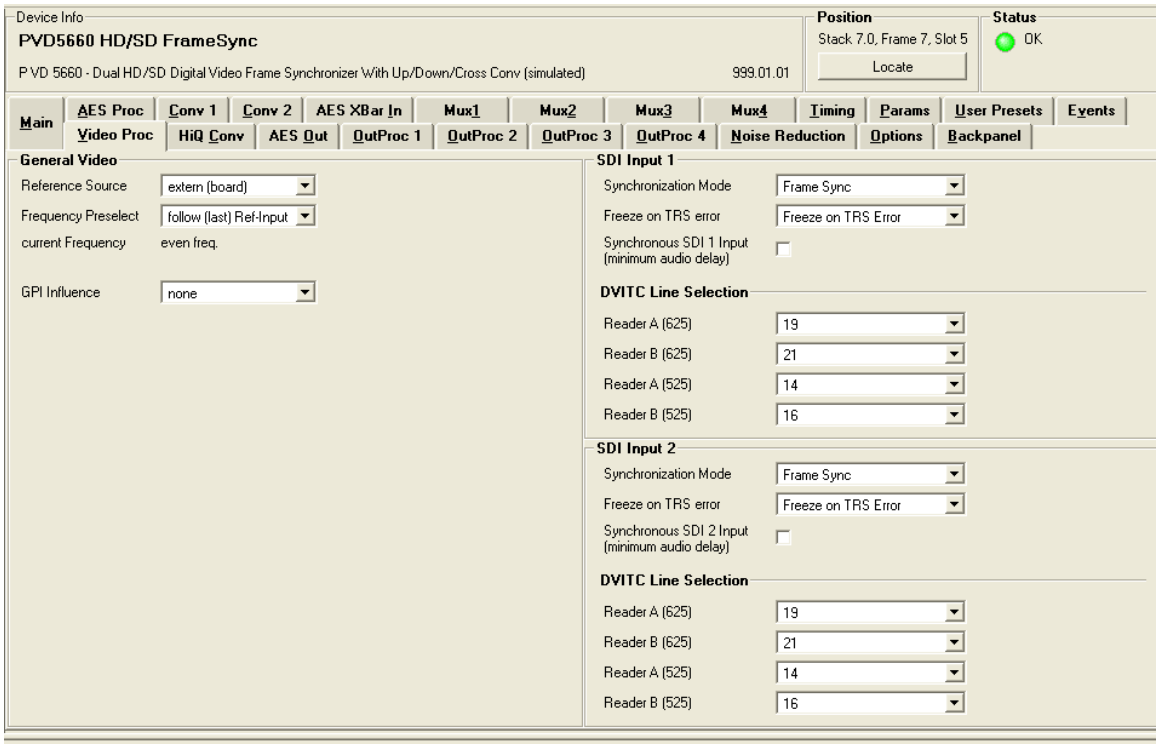
REF in Select

There is a select list next to the **REF in** connection. This selects if the reference signal is to be used from the common rack reference input (intern(rack)) or the board connection plate reference input (extern(board)). The reference for the frame synchronizer can also be derived from the digital inputs. This is useful for applications where the P VD 5660 is used as a video delay line.

Signal Routing

In the center of the screen there is an area where the internal signal routing can be changed. This area is fundamental to the modules flexibility and function. Here the internal video signals can be routed through (or bypassing) the internal resources (Up/down/cross conversion options / ARCs etc). Selecting a cross point via the radio button closes the connection (operation is self explanatory)

Video Proc Tab



General Video Settings

The first area covers some General setup parameters for the frame sync operation.

External Reference Source

It is possible to take the external reference signal from three sources. Either from the common rack reference (*an external reference connection to the rack frame which is fed to all cards installed in the rack*) or via the BNC connection provided on the module rear connection panel, or from either of the two video inputs. Selections provided are:

- External (board) = Via module rear connection panel
- Internal (rack) = Common rack reference

Frequency Pre-select

This is where the frame synchronizer output frequency (or frame rate) is selected. This can be jammed into a frame rate which will never change to maintain this constant output frame rate at all times regardless of the connected reference signal, or any disturbance to the connected reference signal. This will prevent the output frame rate and format automatically “tracking” the connected reference standard should this change. The output video signal will maintain the “jammed” to the video frame rate but the video will be disturbed if the input reference signal changes.

It is also possible for the synchronizer to configure the output frame rate based upon the connected reference. This is the default setting for the module. Possible settings are:

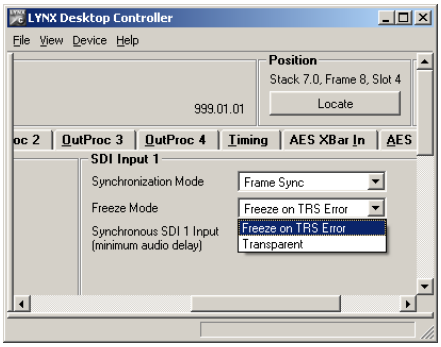
- Even (24, 25, 30 or 50 Hz)
- Odd (23,98, 29,97 or 59,94 Hz)
- Follow (last) reference (default)

Note. *The synchronizer is supplied from the factory with the last stored reference as 50Hz. With no reference connected its possible to change the last stored reference to something else. Simply select the desired fixed frequency and then re-select "follow last reference". Now the module will use this new setting through a power cycle*

Also, this value will not be restored to 50Hz following a "Restore Factory Defaults" operation, the stored setting is preserved.

The "Current Frequency" area in the GUI is showing the frequency the frame synchronizer is running in currently (useful if the *follow last reference* selection is made)

Freeze Mode



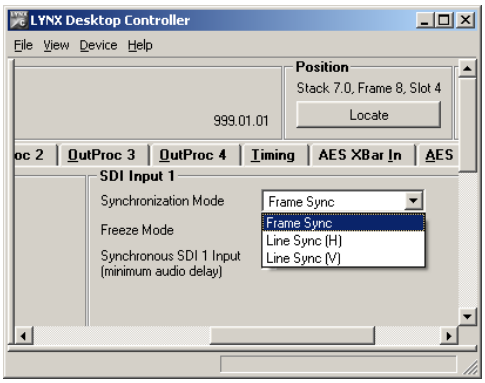
This is where the reaction of each channel is defined in the case of excessive video errors (TRS Errors). The output can be configured to freeze ("Freeze on TRS Error") or pass the input signal transparently when excessive errors are encountered. If configured to pass video transparently ("Transparent") then all video errors and disturbances are passed from the input to the output.

The synchronizer is very robust in its ability to handle poor quality input signals but there may be occasions where excessive errors cannot be recovered by the synchronizer. This is generally qualified by TRS errors. TRS means "Timing Reference Signals" and is a sequence of digital values embedded in the SDI data streams. If the frame synchronizer cannot recover these errors, then the channel will freeze the video until the errors can be recovered. One function of the synchronizer is to repair any bad TRS values ensuring a stable and technically correct video stream is delivered on the outputs. Selections for each channel are as follows:

- Freeze on TRS errors
- Transparent

Note. *The function of the freeze operation is defined in each output video proc stage (Freeze Mode).*

Synchronization Mode



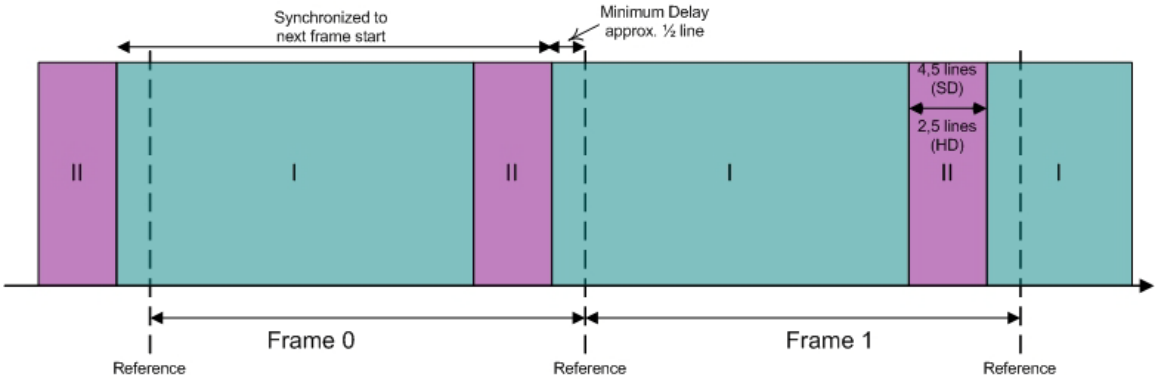
Three different modes of synchronization can be selected:

Frame Synchronization: The input signal is always buffered for 1 frame. TRS errors can be hidden with a freeze frame of the last valid frame. Also repeat frames in case the input clock is lower than the reference clock will be generated from the last buffered frame
Delay input to output is always minimum 1 frame plus the timing difference of input signal to Reference

Line Sync (H): In case of clock synchronized signals the Line synchronizer H mode can be activated to achieve minimum delay. The input signal is buffered for 1 line to correct timing differences within 1 line
A minimum delay of approx. ½ line before the start of the next line has to be maintained to compensate for the processing delay of the P VD 5660.

Line Sync (V): In this mode the synchronizer delays the input signal towards the next frame start to achieve horizontally and vertically aligned pictures. The delay is then the timing difference of the input signal to the Frame Pulse of the Reference. This results in frame aligned signals without the additional 1 frame delay of the frame synchronizer mode.

A minimum delay of approx. ½ line before the start of the next frame has to be maintained to compensate for the processing delay of the P VD 5660.



For distortion free switching in front of the P VD 5660, e.g. in a router, all signals have to be in area “I” or all signals in area “II”.

Area “II” is a window for line synchronization of 2.5 lines (HD) and 4.5 lines (SD).
Area “I” is an extension of the standard line synchronization to allow for “infinite” line synchronization. As this extended functionality is buffered differently, distortion free switching is only possible within these two areas.

To adjust the timing of video signals relative to the reference to avoid larger delays the video output delay function can be used (see page 60). This shifts the video signal into the required area. This adds the manually adjusted delay, but avoids the additional frame delay, e.g. if a signal is in the area of the minimum delay.

Note: *In line synch mode the converters are disabled, when converters are active frame synch mode is required*

Synchronous SDI Input (minimum audio delay)

If activated the embedded audio to video delay at the output is always minimal. This should be used for clock synchronized signals only

DVITC Input Line Selection

DVITC Line Selection for the two DVITC Readers per input signal is provided. If a specific line is selected the presence detection will indicate a DVITC signal only if present in the selected line.
Selecting AUTO will enable a search for DVITC signals in any line.

NOTE: An AUTO search can take longer (up to 15 seconds)

See also Advanced Meta Data Settings (Page 51)

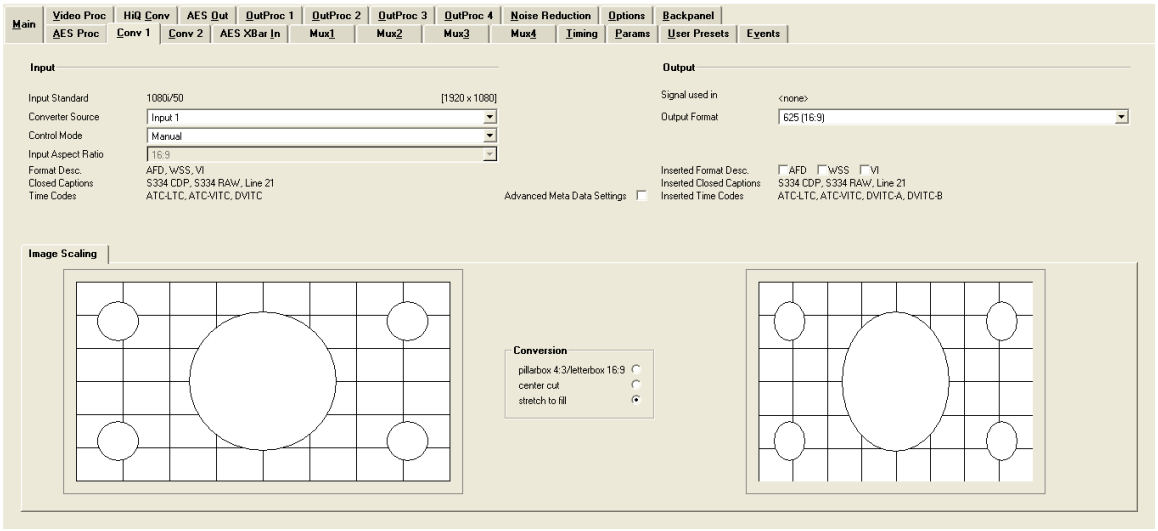
Conv1 / Conv2 Tab

Video Converter 1 and 2 (OC-5660-DWN option)

This tab (identical for Converter 1 and Converter 2) will display the configuration screen for the two basic down converters
(OC-5660-DWN option). This screen can also be accessed by clicking on the “Conv 1” resp. “Conv 2” box in the flow diagram on the main GUI screen.

The down converter functionality in this section will only be active if the OC-5660-DWN options (one for each down converter) have been purchased and installed.

Options are installed via a license string (purchased separately), these are entered into the module to activate the options. Option licenses are managed / entered using the Options Tab in the GUI.



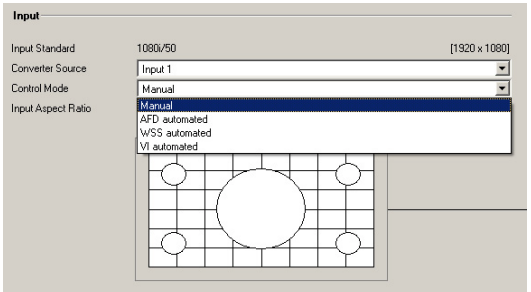
The small graphics left and right per channel display directly the settings of the down converter and the resulting output format.

Converter Source

It’s possible to select the signal source into each down converter. This is done using the first drop down box “Source” This can be Input 1 or Input 2. (This can also be changed using the signal router on the Main Tab)

Control Mode

The down converters can be automatically controlled by AFD, WSS or VI. Selection is made from the drop down box. Depending on what codes are detected in the input signal and the converted output format; the down converters are automatically preset for this mode of operation.



Input Aspect Ratio

For SDTV inputs the aspect ratio (4:3 or 16:9) can be selected

Down Converter Mode

The down converter provides three modes which can be selected using the radio buttons provided:

- Pillarbox / Letterbox
- Center cut
- Stretch to Fill

The “Input standard” and the “signal used in” indicate which input format is routed to the specific conversion channel, and also indicates which of the four outputs the converter output is routed to (these will change if the internal signal routing is changed).

Output Format

With this selection you can choose the output video format. The selections possible are qualified by the frequency preselection (see Video Proc Tab, page 43) and the attached reference signal. For SDTV output formats the aspect ratio can also be selected.

Inserted Format Description

With the three checkboxes you can select what type of format description will be inserted into the video signal as metadata. This information is derived from the settings made to the converters. If there was already metadata of this type inserted in the input signal they will be overwritten (if the related checkbox is selected).

NOTE: *If the checkbox is not selected then no data will be inserted and any existing data will be blanked*

SDTV Aspect Ratio Converter Mode

The Aspect Ratio Converter provides three modes for 16:9 to 4:3 conversion and three modes for 4.3 to 16:9 conversions, which can be selected using the radio buttons provided:

16:9 to 4:3 Conversion

- Letterbox
- Center cut
- Stretch to Fill (vertical)

4:3 to 16:9 Conversion

- Pillar Box
- Center cut
- Stretch to Fill (horizontal)

The “Input format” and the “signal used on” indicate which input format is routed to the specific conversion channel, and also indicates which of the four outputs the converter output is routed to (these will change if the internal signal routing is changed).

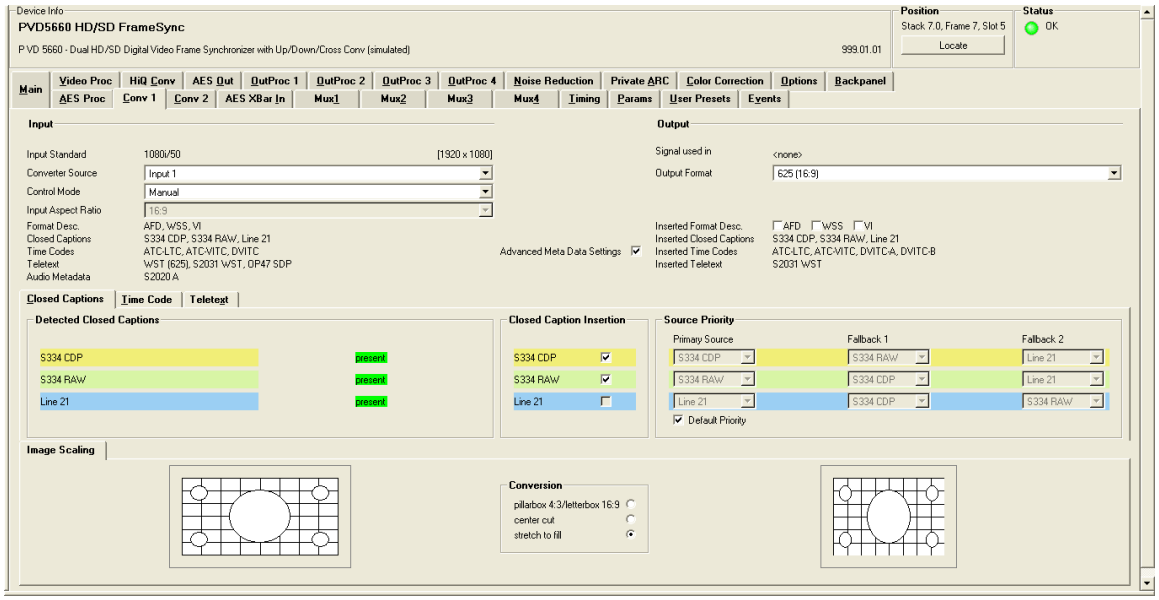
Advanced Metadata Settings

On the left side all detected Meta Data is displayed, on the right side all (re-) inserted Meta Data is displayed.

Note: The P VD 5660 is transparent for Dolby Metadata (S2020), if Dolby Metadata is detected it will be displayed only in the input part of this window (left side).

To configure the insertion of Meta Data please activate the Checkbox “Advanced Meta Data Settings” in the center.

The following screen will be shown, with the Meta Data Handling in the middle, this is identical for all three converters in the P VD 5660:



Closed Captions:

Detected Closed Captions:

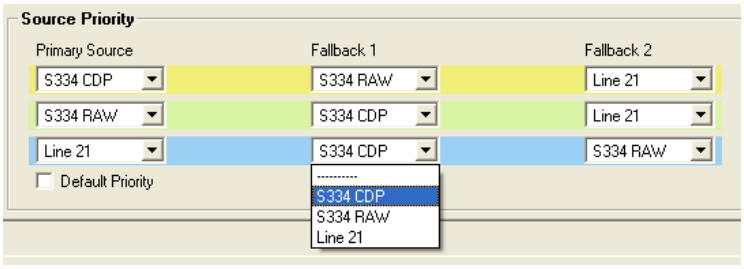
- **S334CDP**: Closed Captions in S334 CDP transport packet (containing CEA-708 and/or CEA-608 data)
- **S334RAW**: Closed Captions in S334 RAW transport packet (containing CEA-608 data)
- **Line21:** Closed Captions in Line 21 (containing CEA-608 data, in 525 video standard only)

Detected Closed Captions transport packets are indicated with “present” with green background.

Closed Captions Re- Insertion:

Activating the respective checkboxes will enable the re-insertion of the different transport packets into the converter output. Transport packets can be generated from different incoming types.

A source priority selection with three levels for the three possible transport packets is provided. If the “Primary Source” is not present, “Fallback 1” will be used, if this is also missing as a source, “Fallback 2” will be used.



Note: ***If “Default Priority” is active, the Source Priorities are set as shown in the left picture, i.e. the “Primary Source” is set to provide standard transparency***

Time Code:

DVITC

Digital Interval Time Code (SMPTE 266M 2008)

Description

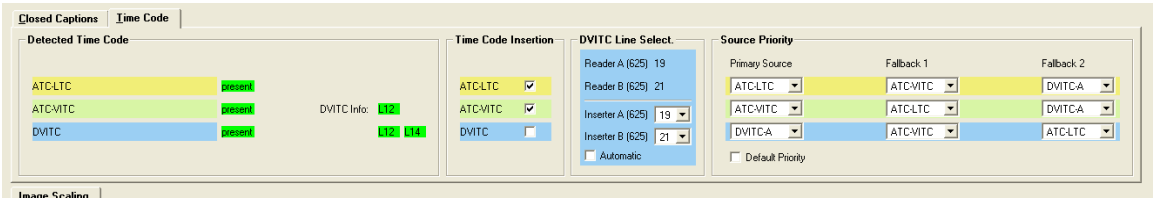
D-VITC is an 8-bit digital data representation of the band-limited analog signal corresponding to the vertical interval time code (VITC) of SMPTE 12M and IEC 60461. The 8 bits of D-VITC shall be carried in the 8 most significant bits of the 10 bits of the ANSI/SMPTE 125M or ITU-R BT.601 coding. Since some equipment may be built using only 8 of the 10 bits, both 10- and 8-bit interpretations of the values are given in this standard, with 10 bits the preferred expression. DVITC is only present in SDTV (525/625).

ATC

Ancillary Time Code (SMPTE 291M 2008)

Description

The acronym ATC refers to ancillary packets carried in the Ancillary space (VANC or HANC) of a digital television data stream, as described in SMPTE 12M-2 (formerly SMPTE RP 188), and payloads of these packets convey LTC or VITC codeword data.



Detected Time Code:

ATC-LTC, **ATC-VITC** and **DVITC** will be detected if present in the incoming video signal

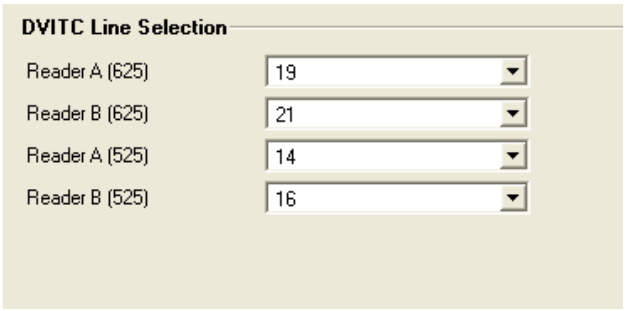
Detected Time Codes are indicated with “present” with green background. For **DVITC** also the insertion lines are indicated. For **DVITC** two insertions per video signals are possible, normally the second insertion is a duplicate of the first one.

For **ATC-VITC** a **DVITC** Index is shown, indicating the original insertion line of the **VITC** signal, which will be used if converted back to **DVITC**

In the Video Proc Tab a **DVITC** Line Selection for the two **DVITC** Readers per input signal is provided. If a specific line is selected the presence detection will indicate a **DVITC** signal only if present in the selected line.

Selecting **AUTO** will enable a search for **DVITC** signals in any line.

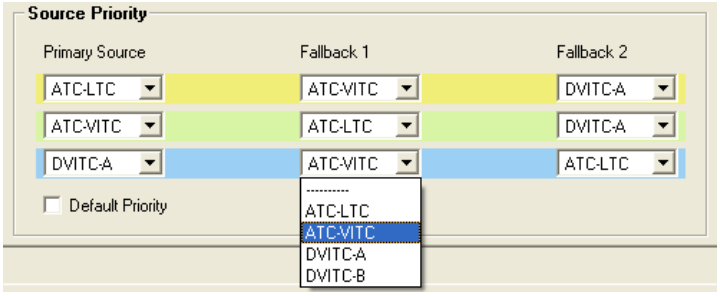
NOTE: *An AUTO search can take longer (up to 15 seconds)*



Time Code Insertion:

Activating the respective checkboxes will enable the insertion of the different time codes into the converter output. The three time codes can be generated from different incoming types.

A source priority selection with three levels for the three possible time code types is provided. If the primary source is not present, Fallback1 will be used, if this is also missing as a source Fallback 2 will be used.



Note: *If “Default Priority” is active, the Source Priorities are set as shown in the picture above, i.e. the “Primary Source” is set to provide standard transparency*

Note: *DVITC is only present in SDTV*

DVITC Line Select:

DVITC can be inserted twice (Inserter A and B) into the output signal with selectable line numbers (line 6..22). See table below.

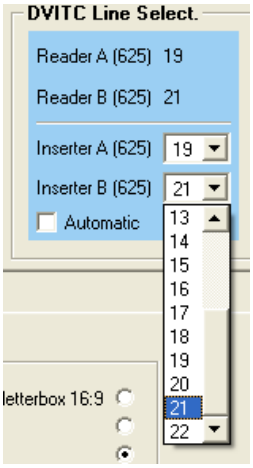


Table 4 – VITC Line select number (SDTV interfaces only)

(VITC line select number)					525/60		625/50	
					bit b5 = 0	bit b5 = 1	bit b5 = 0	bit b5 = 1
DBB2 bits b4 through b0					VITC on line N	Repeated VITC on line (N+2)	VITC on line N	Repeated VITC on line (N+2)
b4	b3	b2	b1	b0	field 1/field 2 [3]	field 1/field 2	field 1/field 2	field 1/field 2
0	0	1	1	0	—	—	6/319	8/321
0	0	1	1	1	—	—	7/320	9/322
0	1	0	0	0	—	—	8/321	10/323
0	1	0	0	1	—	—	9/322	11/324
0	1	0	1	0	10/273	12/275	10/323	12/325
0	1	0	1	1	11/274	13/276	11/324	13/326
0	1	1	0	0	12/275	14/277	12/325	14/327
0	1	1	0	1	13/276	15/278	13/326	15/328
0	1	1	1	0	14/277	16/279	14/327	16/329
0	1	1	1	1	15/278	17/280	15/328	17/330
1	0	0	0	0	16/279	18/281	16/329	18/331
1	0	0	0	1	17/280	19/282	17/330	19/332
1	0	0	1	0	18/281	20/283	18/331	20/333
1	0	0	1	1	19/282	—	19/332	21/334
1	0	1	0	0	20/283	—	20/333	22/335
1	0	1	0	1	—	—	21/334	—
1	0	1	1	0	—	—	22/335	—

Teletext

WST
World System Teletext

Description
Normally analog information designed mainly for PAL TV. In the context of the P VD 5660 it is an emulation of analogue teletext for digital TV.

S2031 WST
SMPTE 2031: Carriage of DVB/SCTE VBI Data in VANC

Description
This Standard specifies how to carry the digital values resulting from defined standardized data streams carried in MPEG-2 Transport Streams (TS) as specified by either DVB/ETSI EN 301 775 or SCTE 127 (or both) as ancillary data packets in the vertical ancillary data space (VANC).

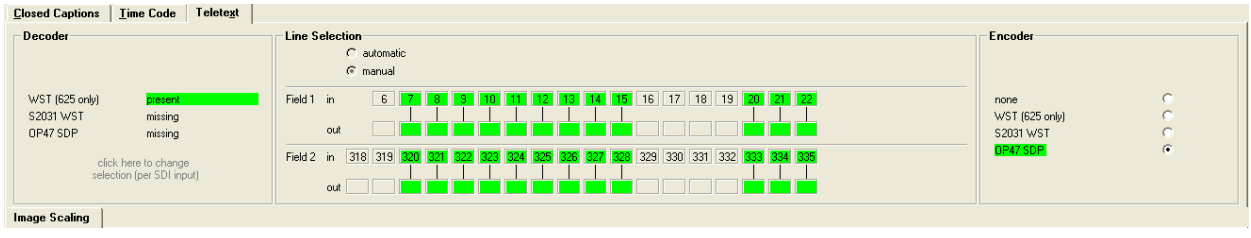
Note: *In the P VD 5660 only teletext data (digital teletext data derived from WST) in the data packets will be detected and processed*

OP47 SDP
Free TV Australia Operational Practice OP- 47
STORAGE AND DISTRIBUTION OF TELETEXT SUBTITLES and VBI DATA FOR HIGH DEFINITION TELEVISION

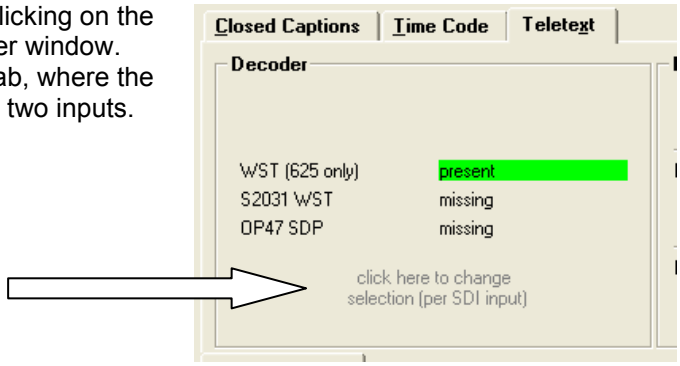
Description
Free TV Operational Practice OP-47 describes the technical/operational practices associated with the storage and distribution of Closed Caption/Subtitling data in the vertical ancillary space of the 10 bit serial HD-SDI signal complying with ITU-R BT.1120-7.

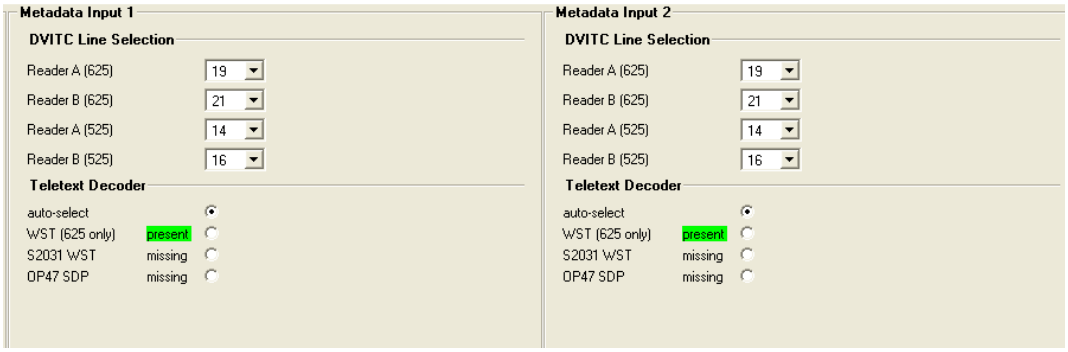
Note: *In the P VD 5660 only teletext data (digital teletext data derived from WST) in the data packets will be detected and processed.*

Teletext Decoder
Selecting the teletext tab will show the control window below:
The teletext decoder indicates what type of teletext is detected. A valid teletext is indicated with a green background.



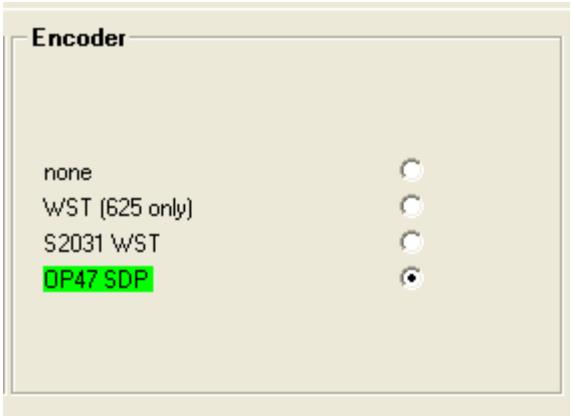
A pre-selection can be set by clicking on the text at the bottom of the decoder window. This will open the Video Proc tab, where the pre-selection can be set for the two inputs.





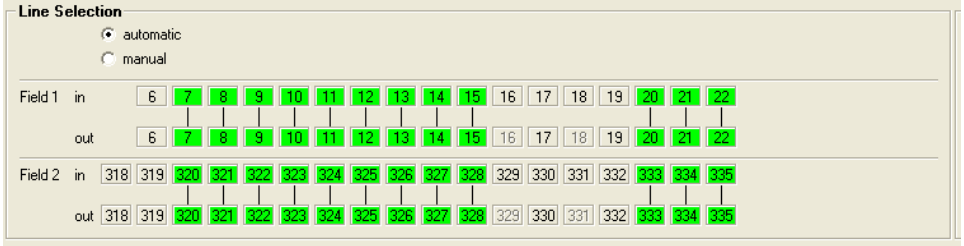
Teletext Encoder

The encoder is used for the insertion of the teletext data into the respective converter.



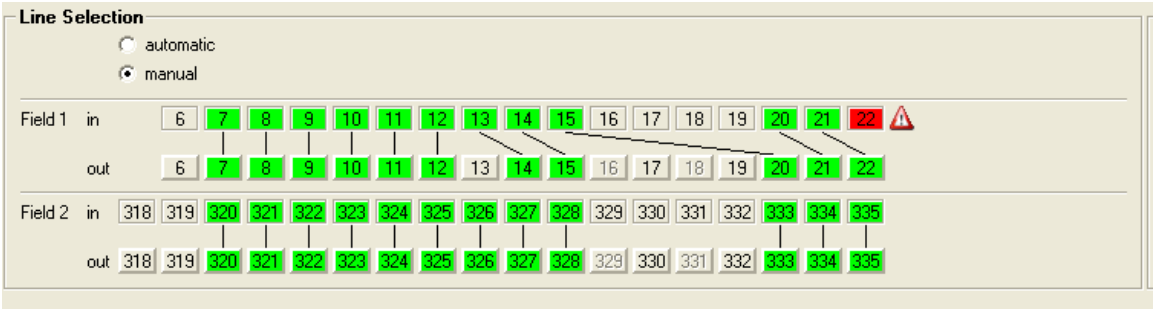
If WST teletext data is present / selected then the line numbers containing teletext data on both the input and output are shown. The green designation indicates valid teletext data is present.

Note: *If S2031 or OP47 SDP Teletext is detected / selected then no line numbers will be shown*



In automatic mode the output line numbers equal the input line numbers. Manual mode has to be selected to change the output line numbers.

Manual Input to output line mapping can be changed by clicking on the respective line number



The encoder always tries to map the same input line to output line, in our example above line 17 and 19 are not used on the output as they were not used in the input. Clicking on these line numbers would activate their use in the output.

Line numbers in light grey are already occupied by other metadata with analog origin (e.g. DVITC).

If there is a conflict or problem, (e.g. one line gets lost), a warning in red will be shown as indicated above.

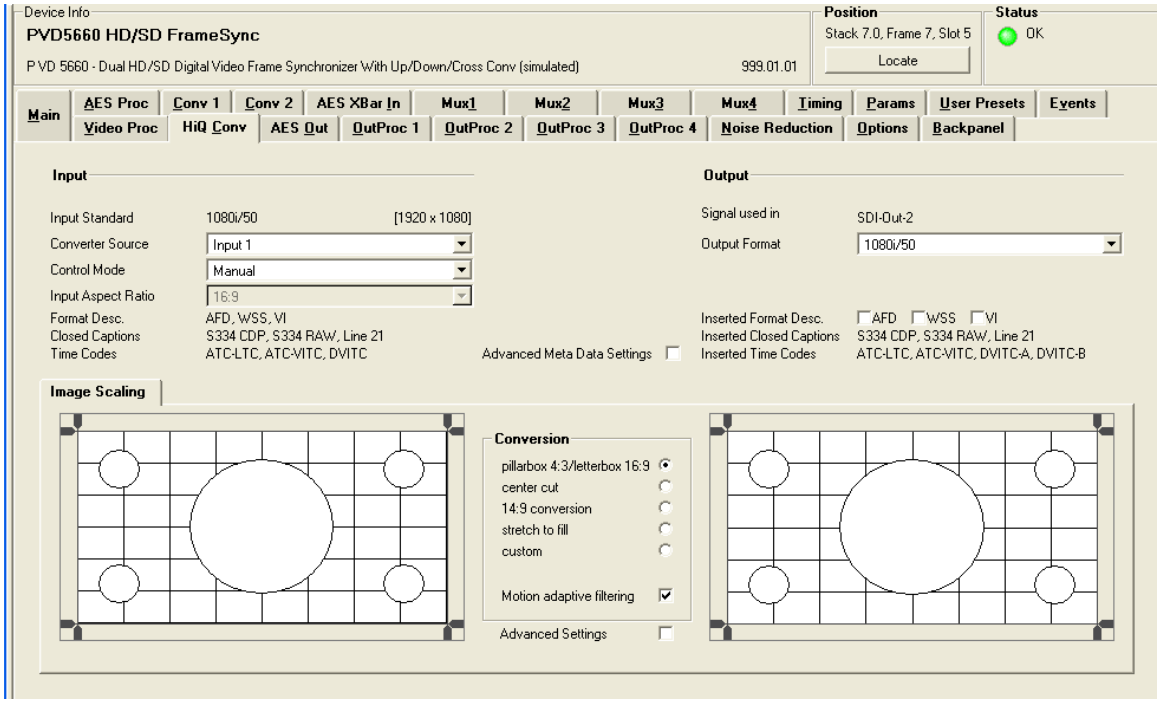
HQ Scaler Tab

The OC-5660-UPXD option is required for the HQ up, down and cross conversion functionality.

For the basic module without the OC-5660-UPXD option installed this converter provides the HQ SDTV Aspect Ratio Conversion functionality. Please see section “Aspect Ratio Conversion Mode” above for functionality.

If the OC-5660-UPXD option is activated this also provides Down Conversion functionality as described previously.

The screen below shows the controls provided for the HQ Up, Down, Cross and Aspect Ratio Conversion.

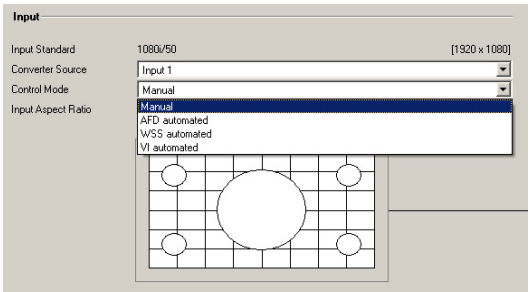


HQ Scaler Source

This selection allows the input source to the scaler to be selected, this can also be set using the signal routing selections on the Main Tab. Selections possible are “Input 1” and “Input 2”

Control Mode

The converter can be automatically controlled by AFD, WSS or VI. Selection is made from the drop down box. Depending on what codes are detected in the input signal and the converted output format; the converter is automatically preset for this mode of operation.



Input Aspect Ratio

For SDTV inputs the aspect ratio (4:3 or 16:9) can be selected

Output Format

With this selection you can choose the output video format. The selections possible are qualified by the frequency preselection (see Video Proc Tab, page 43) and the attached reference signal. For SDTV output formats the aspect ratio can also be selected.

Inserted Format Description

With the three checkboxes provided you can select what type of format description will be inserted into the video signal as metadata. This information is created depending on the settings of the converters. If there was already metadata of this type inserted it will be overwritten (if the related checkbox is selected).

NOTE: *If the checkbox is not selected then no data will be inserted and any existing data will be blanked*

Conversion Mode

With the selection box in the middle of the screen the conversion mode can be selected. The check box “motion adaptive” filtering is used to improve picture quality for moving images and reduces motion blur, and should be selected for normal use. For still images and conversion from progressive to progressive standards the checkbox should be switched off.

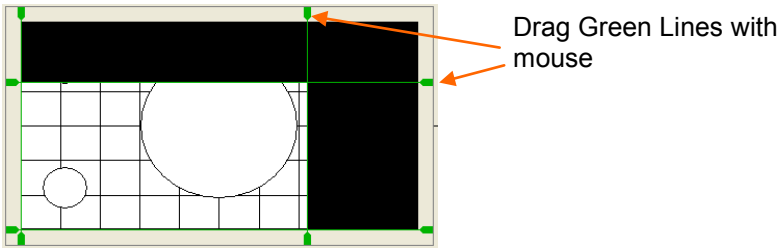
Input Cropping

With these controls it’s possible to crop the input image which will be used for conversion (cropping will appear on the converted image output). To use this function the “advanced settings” checkbox has to be activated.

Output Cropping

With these controls the size and positioning of the output image can be set. Any parts of the image which has no content (cropped on the input or outside the image extents if shifted or made smaller) will be filled with black. To use this function the “advanced settings” checkbox has to be activated.

Note. *It is also possible to manually drag the input and output cropping extremities using the mouse pointer on the GUI. Simply position the mouse over the green line you wish to move, click and drag the line to the desired point on the image.*

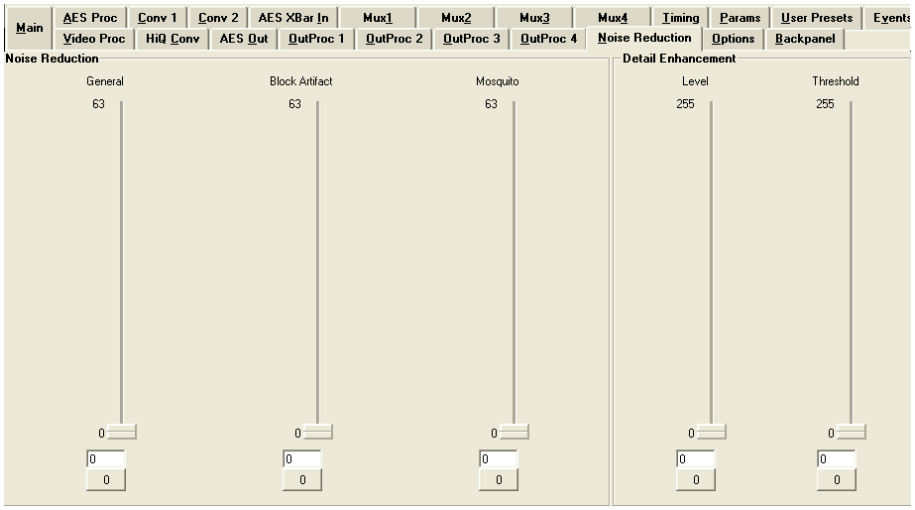


Note. *If a non-standard setting is used, the Conversion setting will jump to “custom”*

Noise Reduction Tab

High Quality Noise Reduction (OC-5660-NR option)

The OC-5660-NR option is required for the HQ Noise Reduction functionality. The screen below shows the controls provided for this function..



The adaptive noise reduction function processes the input data in either progressive or interlaced format. Application of noise reduction to noisy interlaced signals can optimize de-interlacer performance.

General Noise Reduction

General noise reduction comprises of both adaptive 2D and 3D noise reduction. 3D noise reduction corrects for temporal and spatial noise; and 2D noise reduction corrects spatial. 3D noise reduction is applied to any interlaced or progressive signal with a pixel rate less than or equal to 75Mp/s. 2D noise reduction is applied to any interlaced or progressive signal. The selection of 2D or 3D noise reduction processing is automatically controlled by the firmware in accordance with the video signal being processed.

Block Artifact Reduction

Block Artifact Reduction (BAR) locates and reduces block edges produced by DCT based compression processing. BAR can be applied to any interlaced or progressive input signal.

Mosquito Noise Reduction

Mosquito Noise Reduction (MNR) dynamically adapts to image content, effectively reducing mosquito artifacts around sharp edges in DCT based compression. It can be applied to any interlaced or progressive signal.

Detail Enhancement (Sharpness and Texture)

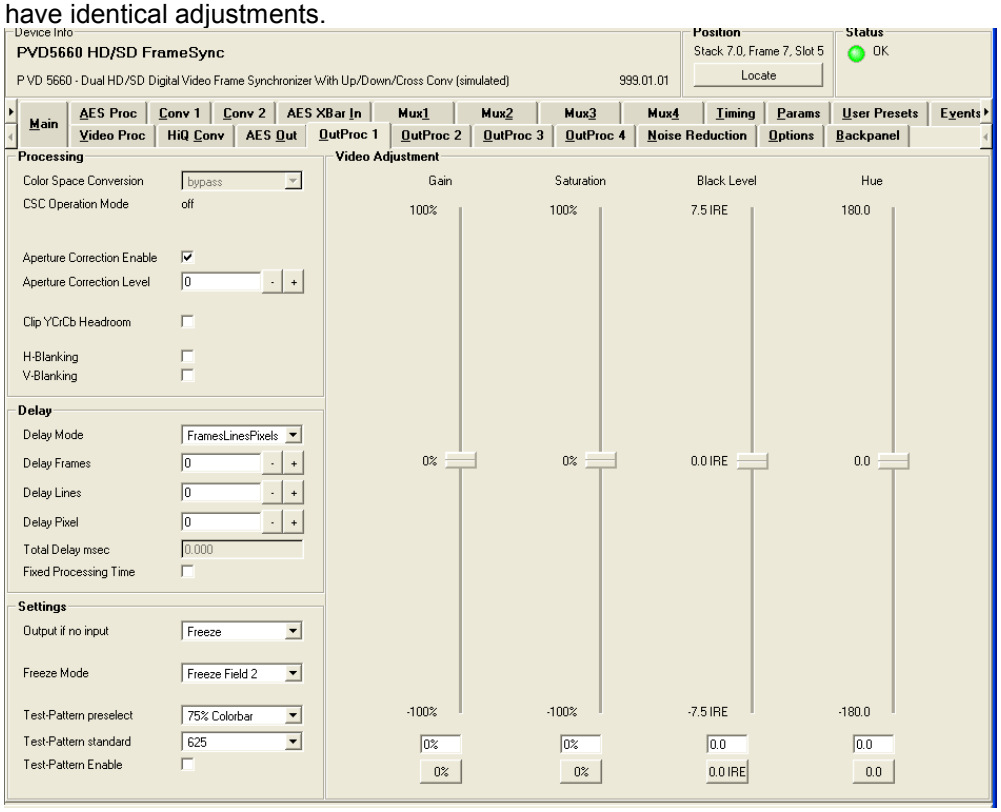
The detail enhancement function provides both sharpness and texture enhancement, realized by adaptive horizontal, vertical and diagonal large edge and small edge enhancement processes. Overshoot / undershoot control is provided to minimize ringing

on the enhanced edges. In addition, noise rejection is provided to minimize the amount of enhancement applied to the noisy areas of the image.
For ease of use the various controls are combined into two parameters: Level and Threshold

- **Level:** controls the level of the horizontal, vertical as well as the diagonal high pass filtered picture content, which will be added to the original signal again, i.e. the gain of the high frequency content in the signal.
- **Threshold**: This parameter controls the level of signal which is passed through for level control, i.e. all amplitudes in the signal below this threshold will not be used for the detail enhancement.

Output Proc Tabs

There are four “Out Proc” tabs provided, one for each of the four outputs provided. This is where the individual video processing functions are set for each channel. All four tabs have identical adjustments.



Color Space Conversion

Note. *This is only active when the conversion option(s) are installed (OC-5660-DWN and/or OC-5660-XUPD)*

This is where the color space conversion functionality is configured. This is used to ensure correct color reproduction on the outputs. HD color space is wider than SDTV color space so there is the possibility of some illegal colors being reproduced if the color space is not converted. Possible selections (only for the two down converts, automatic for HD Converter) are:

- Convert *(convert the video signal)*
- Bypass *(perform no conversion)*
- Luma in Bypass (*only convert Chroma portion of signal*)

Aperture Correction

Horizontal aperture correction is provided for each output channel, which can be used to sharpen or soften the video signal. (This is sometimes required for down converted video signals as the filtering process rolls off the high frequency very slightly). If adjusted in the positive direction this will increase sharpness, if adjusted in the negative direction this will soften the image.

There is a check box to switch aperture correction ON and OFF and an adjustment range The numerical adjustment range provided is + 80 to -30, and is changed by clicking on the "+" or "-" Buttons.

> **Note.** *Aperture correction OFF is the same as a Zero setting in the adjustment range*

Clip CR/Cb Headroom

If activated all Luminance (Y) values below 64 and above 940, and all Chrominance (Cr,CB) values below 64 and above 864 will be clipped.

H and V Blanking

A checkbox selection is provided for H (Horizontal) and V (Vertical) blanking. When selected the video output will have new blanking applied in both of these areas (which will overwrite any information in the vertical and horizontal blanking intervals).

Video Output Delay Adjustment

Each video output can be delayed relative to the reference sync up to a maximum of 3 frames. This is usually used for downstream system timing applications. The delay is adjustable in the following increments:

- Frames
- Lines
- Pixels or
- Total Delay in ms

Depending on preferences you can use one or all of the adjustments provided to set the total video delay.

> **Note.** *The adjustable delay applied is **in addition** to the fixed processing delay of the module. Please refer to the tables provided in the "Fixed Video Processing Delays" section for more information on processing delays.*

Note: *Using the "Fixed Processing Time Time" makes sure the processing delay is always the same (max.delay). This function can be activated in the "OutProc" Tab of the respective output or on the "Timing" Tab.*

Settings

This area is where the freeze function is defined and also the action (and settings) of the integrated test pattern generator. (Each channel has its own independent test pattern generator)

Output if no input

Here the behavior of the P VD 5660 can be selected if no input is present

- Freeze
- Black
- Test Pattern

Freeze Mode

When the synchronizer encounters excessive TRS errors it can be set to freeze or pass the video transparently (selected on the Video Proc tab). If Freeze is selected then the behavior of the freeze function is selected using the drop down selections. These are:

- Freeze Field 1
- Freeze Field 2
- Freeze Frame

Test Pattern Pre-select

A wide range of patterns is provided which can be selected using the drop down selection provided. The pre-selected pattern will be used if the freeze mode is set to “test pattern” and will also the pattern used if “test pattern on” is selected. Patterns provided are:

- Full field Black
- Full field White
- Full field Yellow
- Full field Cyan
- Full field Green
- Full field Magenta
- Full field Red
- Full field Blue
- 15% Grey (full field)
- 75% Color bars
- 75% Color bars over Red
- Pathological PLL/EQ

Test Pattern Standard

With no input signal connected the module can be used a stand alone test generator using this selection is possible to configure the test pattern into any of the supported standards, or it can be set to follow the last input standard. Settings provided are:

- Follow last input (default)
- Fixed standards (half, same or double or current reference frame rate)

Test Pattern Enable

This checkbox simply switches on the pre-selected test Pattern. Activated test pattern will be indicated on the **Main** Tab.

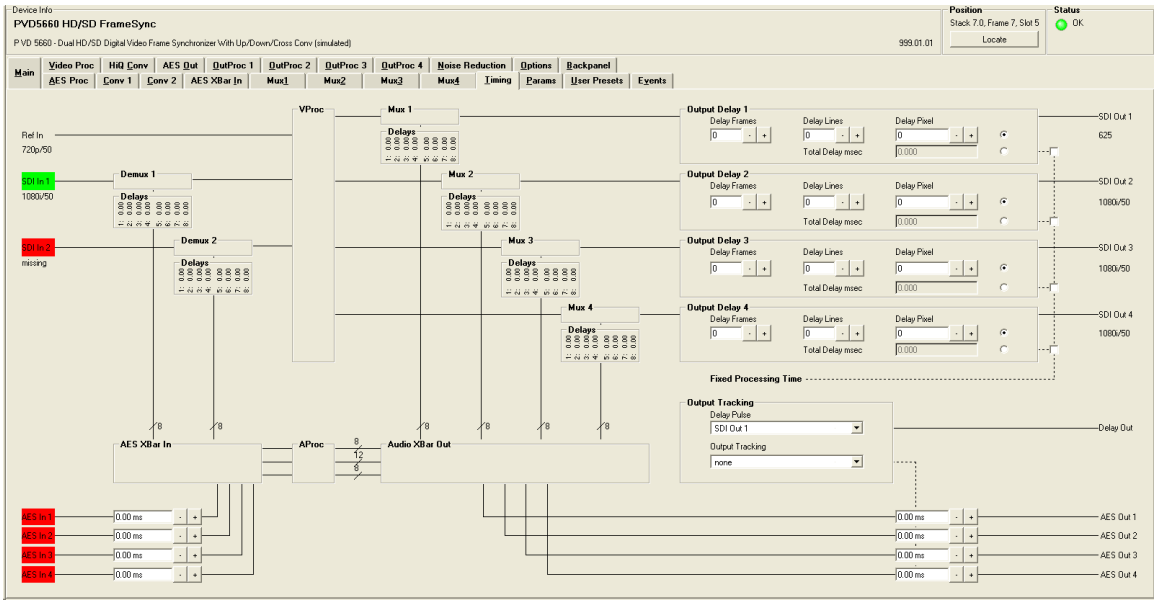
Video Adjustments

Four on screen sliders are provided to allow for the adjustment of individual video parameters. Separate sliders are provided for video Brightness (gain), Saturation, Pedestal (Black level) and Hue.

Default (null) settings are 0% (this is the default). Sliders can be quickly returned to the factory null (or transparent) settings using the buttons provided at the bottom of each slider.

Timing Tab

All manually adjustable delays for audio and video can be set in the GUI shown below.



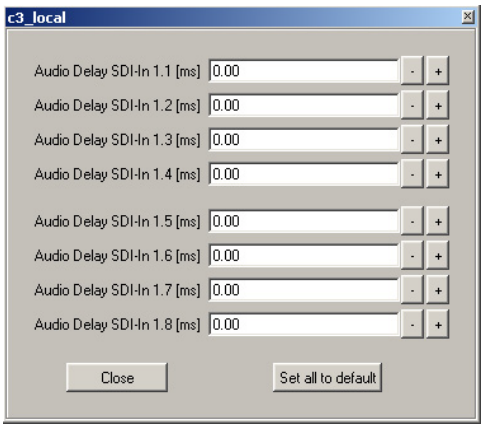
The video delay can be adjusted for the four SDI outputs independently.

If the **Fixed Processing Time** is enabled the respective output is always set to the maximum possible delay (4 frames) independent from the mode of processing. The manually adjustable delay is then deactivated (greyed out). The **Fixed Processing Time** can be set independently for the four outputs.

The audio delay can be set at various positions:

SDI in: Delay of the embedded audio after de-embedding
SDI out: Delay of audio for re-embedding
AES in: Individual delays for the four AES inputs
AES out: Delay at AES outputs

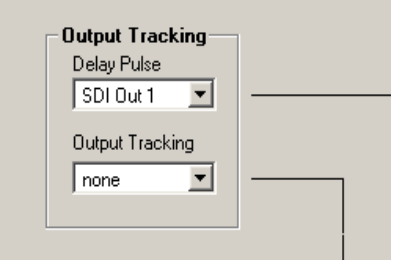
Setting of the audio delay “SDI in” and “SDI out” can be performed in a pop-up window, when clicking on the deembedder/embedder blocks


c3_local
Audio Delay SDI-In 1.1 [ms] 0.00
Audio Delay SDI-In 1.2 [ms] 0.00
Audio Delay SDI-In 1.3 [ms] 0.00
Audio Delay SDI-In 1.4 [ms] 0.00
Audio Delay SDI-In 1.5 [ms] 0.00
Audio Delay SDI-In 1.6 [ms] 0.00
Audio Delay SDI-In 1.7 [ms] 0.00
Audio Delay SDI-In 1.8 [ms] 0.00
Close
Set all to default

Note: The Synchronizer will auto track the audio delay to the video processing delay. The adjustments provided here are offsets relative to the internal tracking delay.

The audio delay offset can be set at various positions as graphically shown in the audio processing chain. Clicking the + and – buttons adjusts the setting. Audio Delay Range is 0.330 seconds total (input to output, set in ms)

The external AES outputs can be linked to one of the auto tracking delays of any of the four SDI outputs using the drop down box “Output Tracking” shown.



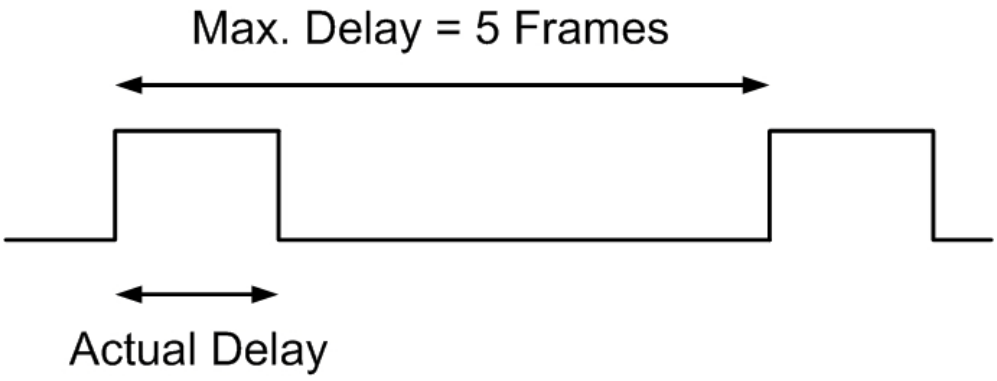
Use the drop down list provided to link the four external AES outputs to one SDI output channel auto tracking delay value.

Select “none” to disable auto tracking delay for the External AES outputs

Note: In case of detected Dolby E signals the input audio delay (AES in or De-embeeders) will be deactivated (control is greyed out) as this delay would be “re-aligned” by the Dolby E Synchronizer again.

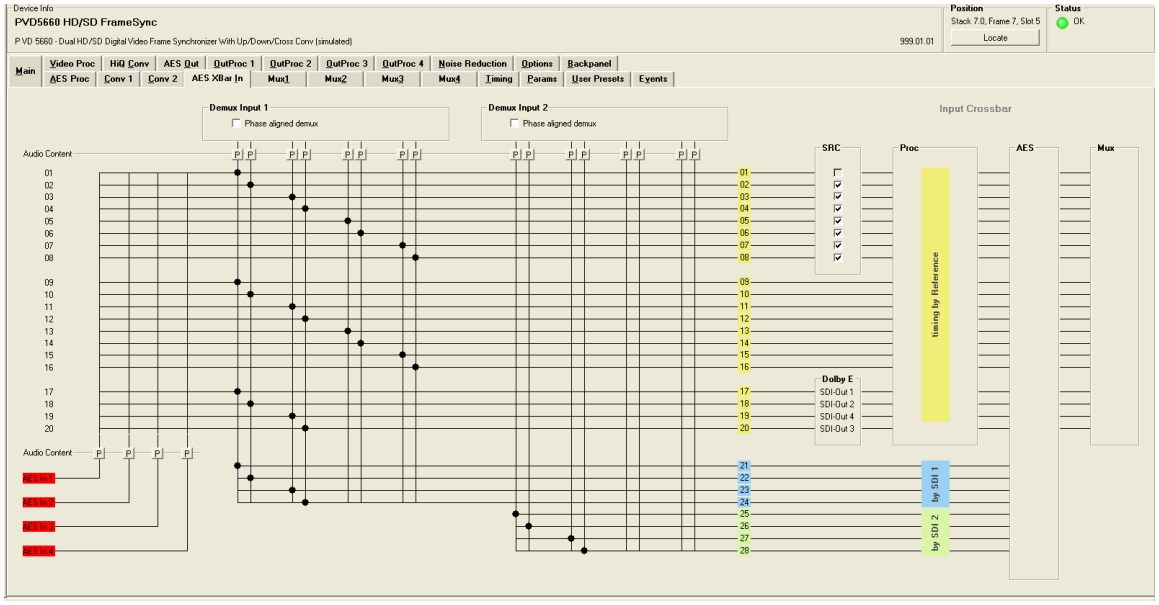
Audio Delay Pulse

The Audio Delay Pulse is connected through a BNC connector with TTL levels
Please select the related SDI output with the drop down list provided.



AES Input Crossbar Tab

The complete audio payload (8 x AES) is de-embedded from each input channel and 4 external AES inputs can be applied to the module. All the audio is fed into an AES audio cross bar which is configured using the GUI below.



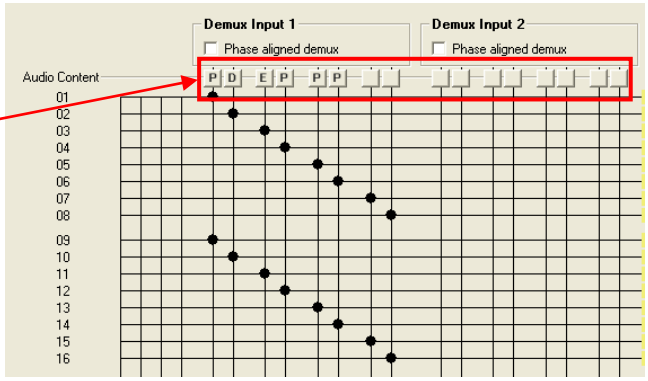
The crossbar arrangement is simple; the inputs from the two de-embedders for each SDI signal come in from the top. The external AES inputs come in from the bottom. All audio inputs are the vertical component of the crossbar. The audio pathways out of the crossbar are horizontal. Routing an AES pair is achieved by clicking on the cross point with the mouse cursor.

Automatic Audio Detection

Audio presence and audio format for the embedded audio on the 2 SDI inputs and the 4 x external AES inputs is automatically detected and displayed on the module GUI in the LYNX control system.

This can be seen below; the small blocks under the de-embedder indicate the audio status for each AES stream:

P = PCM Audio Detected
E = Dolby E Audio Detected
D = Compressed Audio Stream Detected(other than DolbyE)
Blank = No Audio Signal Present

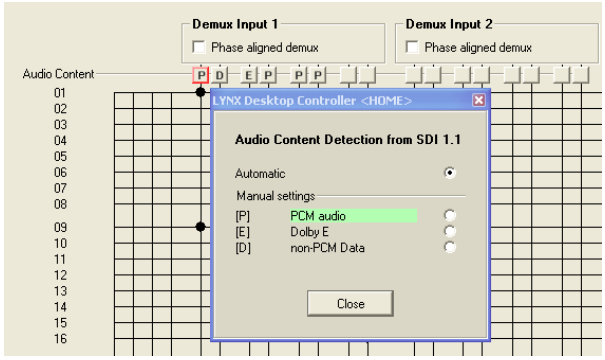


In this example you can see input 2 has no audio present, and input 1 has the following:

AES 1 = PCM Audio
AES 2 = Digital Audio Stream
AES 3 = Dolby E Audio
AES 4 = PCM Audio
AES 5 = PCM audio
AES 6 = PCM Audio
AES 7 = No Audio Present
AES 8 = No Audio Present

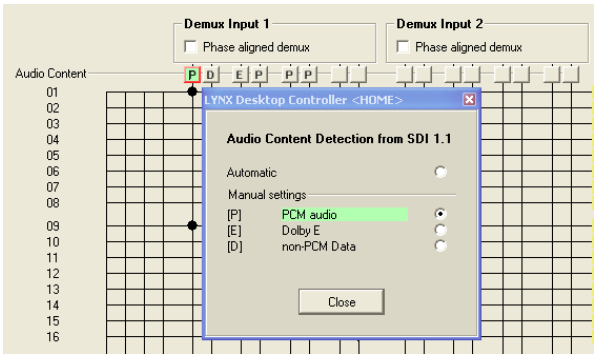
Configuring Audio Inputs

Audio inputs can be configured automatically based on the audio detected, or manually configured to be only a particular type. When an input is manually configured the system will indicate when a conflict exists between the configured setting and the detected audio on that channel.
Clicking on one of the audio boxes with the mouse will bring up the audio configuration dialog for that channel.



The default setting is always automatic, as seen above and for this first input you can see it has detected PCM audio.

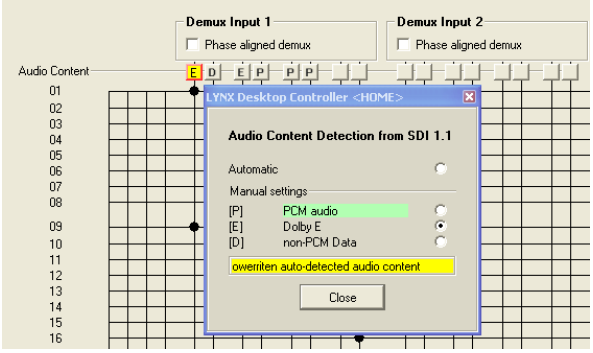
To manually set this input simply click on the respective selection with the mouse



In this case you can see input 1 has been manually configured for PCM audio, and it is highlighted green to indicate it is a manual selection, and there is no conflict. (a box with a letter inside which is not green indicates this channel is configured for automatic detection)

If we manually force this input to DolbyE, this will cause a conflict as PCM audio is present. See below:

Here you can see the conflict is flagged by turning the box yellow. This is indicating the channel is manually preset for Dolby E, but the audio format is in conflict with this setting, in this case PCM audio. **Note.** *Even though there is a conflict the actual audio present is passed through the system – i.e. it is not blocked.*

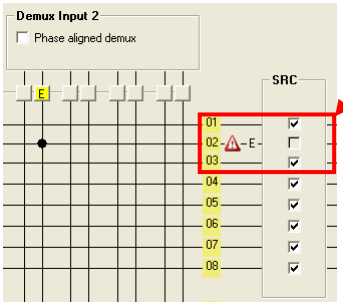


Maintaining DolbyE Transparency

The PVD 5660 can process and synchronize DolbyE signals transparently, but some care needs to be taken as to the routing of the DolbyE signals (or any compressed audio bit stream) through the module. To help maintain transparency the module will automatically bypass any processing stages which might corrupt this signal, and also provide a warning indication in the GUI (indicating there is a possible problem with the specified routing of this signal in the module)

For example, if DolbyE audio is routed through any of the inputs in audio Pathway 1 there are three areas of concern. b) The sample rate converters, b) the audio processing stage c) Synchronization and DolbyE guard band timing.

The module will automatically disable the sample rate converter and bypass the audio processing for this channel in the Audio Processing amp (controls will be greyed out) – so in this case the DolbyE signal will be passed transparently and is ready for re-embedding into the outputs (or passing to an external output). **However** audio Pathway 1 does not have any DolbyE synchronization capability, so the DolbyE audio will not be synchronized and also the guard-band timing could be incorrect. To indicate this conflict a small warning symbol is inserted into the audio line in the control system GUI. See below:

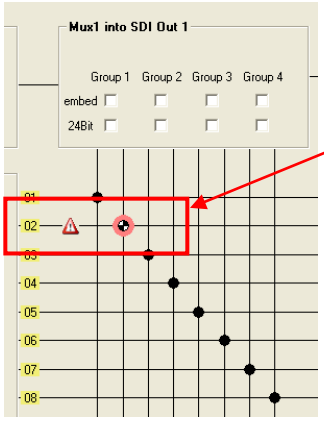


Here you can see DolbyE from input 2 has been routed into audio Pathway 1, channel 2

The module has inserted the warning symbol. **Note**. *The module has automatically greyed out the sample rate converter and has also disabled the downstream audio processing (not seen here)*

A better choice for signal this DolbyE signals is Pathway 3, as this is designed for DolbyE and includes 4 x DolbyE synchronizers and will always maintain the correct guard-band timing.

Another area of concern for DolbyE or compressed audio streams is the mono audio output crossbars. These should not be changed from the default setting for these types of signals. The Module will also provide a visual warning if any of the mono cross points are in conflict.



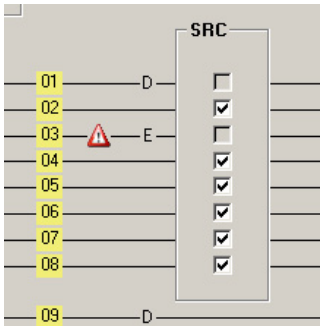
Here you can see the highlighted cross-point has been manually changed from its default settings. The warning symbol clearly indicates there is a conflict with this cross-point setting for the audio signal present.

Note. *For information on how to configure and switch mono cross-points, please refer to the GUI section of the manual*

Pathway 1

The first 8 AES signals out of the crossbar (01…08) represent “Pathway 1” through the Frame Synchronizer. These audio signals are fed through sample rate converters, (which can be turned on and off using the check boxes).

This pathway also has full audio processing functionality available downstream in the module.



Note. *This pathway is not recommended for non-synchronized DolbyE or encoded audio bit streams. If Dolby E or other Audio Data signals are detected this is indicated on respective audio channel.* **The warning for Dolby E signals is indicating that asynchronous Dolby E signals cannot be synchronized through this pathway.**

Pathway 2

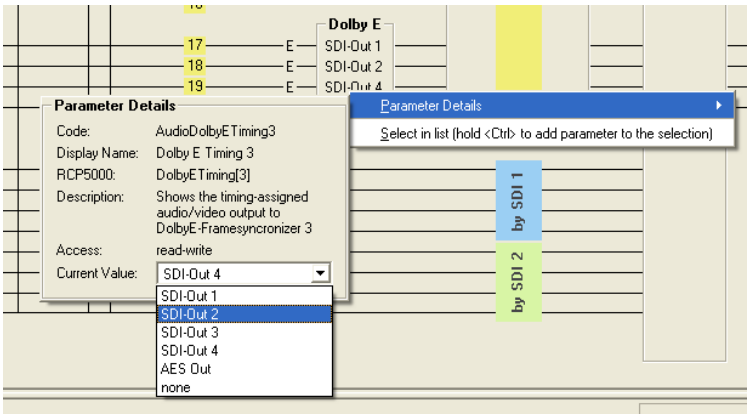
The next 8 AES outputs from the crossbar (09…16) represent “Pathway 2” through the synchronizer. These channels do not pass through any sample rate converters, and audio passed through this pathway is assumed to be synchronous with the connected reference signal (no audio synchronization is performed in the frame sync)

Pathway 3 – Dolby E

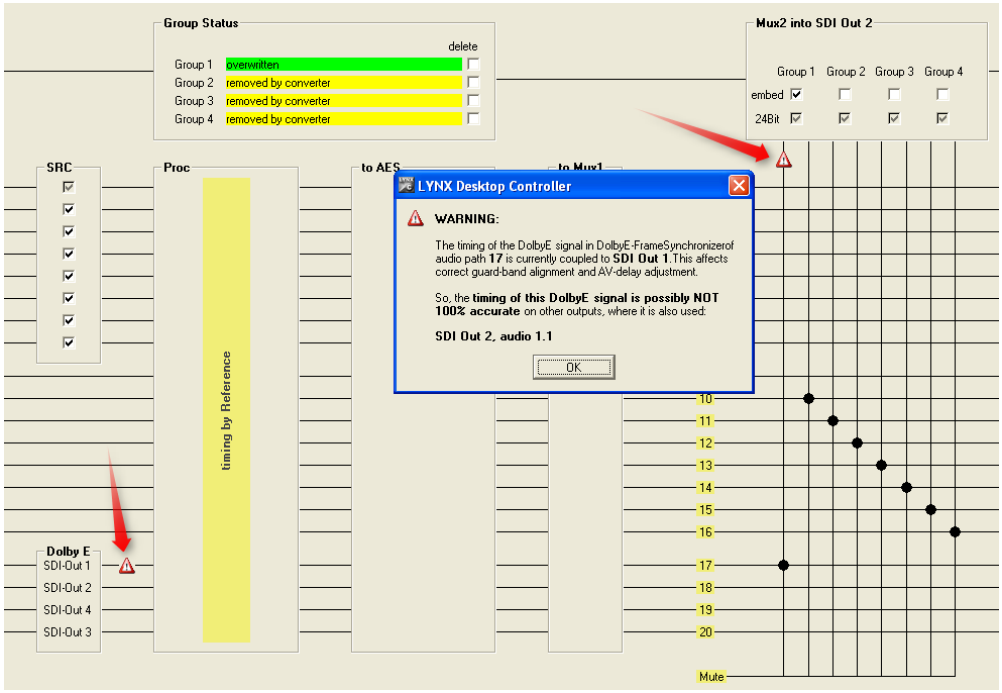
The next 4 AES outputs from the crossbar (17…20) represent “Pathway 3” through the synchronizer. These channels contain 4 Dolby E synchronizers. This pathway allows synchronization of asynchronous Dolby E signals.

The Dolby Synchronizers have to be referenced to one of the video outputs or the AES audio outputs for correct guard band alignment.
This is done automatically when an audio signal through the Dolby Synchronizers is selected for embedding or selected for the AES outputs.

Assignment of the Dolby Synchronizers to the outputs can be done manually by clicking with the right mouse button on the respective Dolby Synchronizer and selecting the output with the pull down list.



If a Dolby synchronizer is used twice an alarm will be shown.
Clicking on the alarm sign will show a message.



Pathway 4 and 5

The next 4 AES signals from the crossbar (21..24) is “Pathway 4 & 5” and is dedicated to SDI input 1. Any 4 of the 8 de-embedded AES streams can be selected and fed through this pathway. The audio maintains its synchronization and timing references to the input SDI signal and is not re-synchronized or processed by the module. The module is simply de-embedding the audio and making it available as external signals.

Audio using these pathways **can only** be fed to the external AES outputs and cannot be embedded back into the output video. (*For example, you could use this pathway to de-embed DolbyE and then feed it to an external DolbyE decoder)*

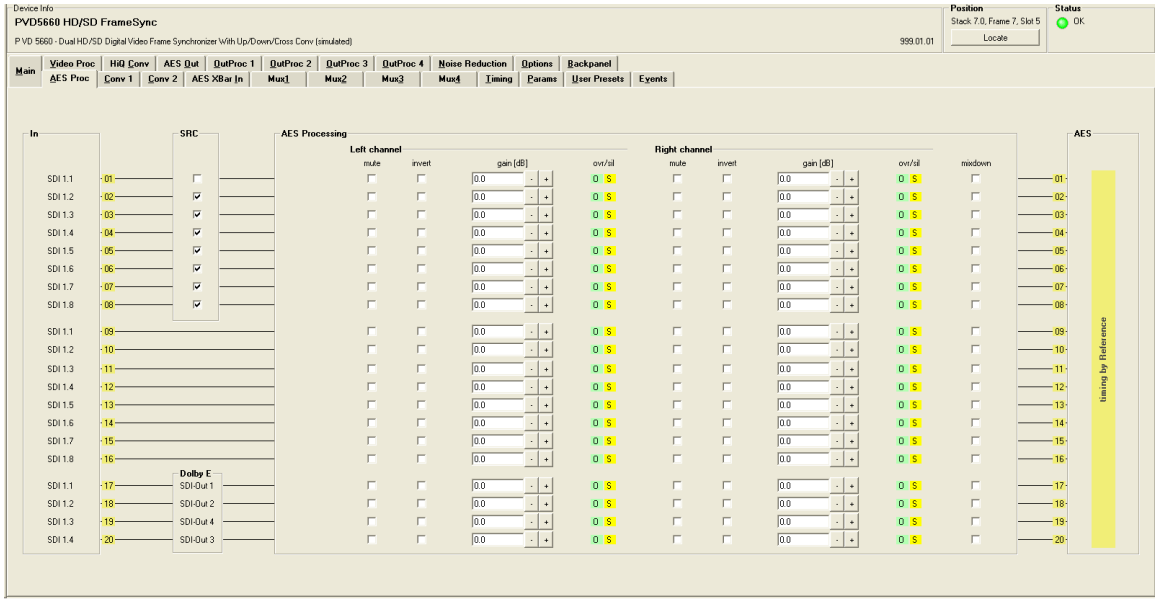
“Pathway 5” is identical in function to Pathway 4 but dedicated to the second SDI input.

AES Proc Tab

This provides access to the internal audio processing functions such as audio gain / mute / phase invert / overload and silence detection per audio mono channel (overload and silence are indicated by color of the respective symbol: Green = OK Red = overload or silence.

A mono mix down function per AES is also provided. This can be activated with the checkbox “mixdown” at the right side.

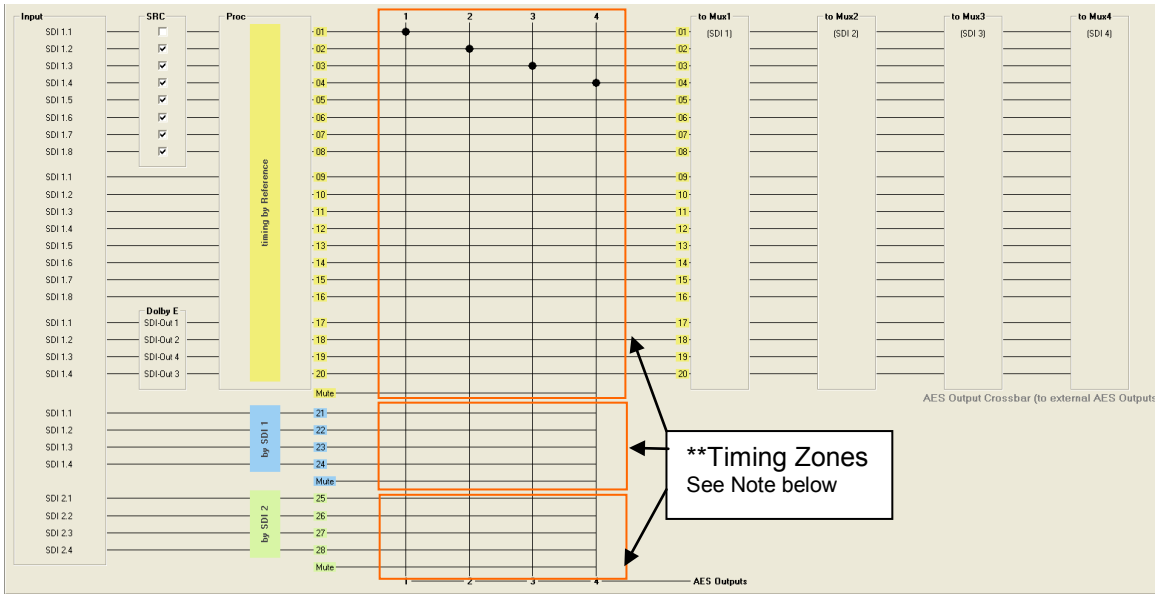
Sample rate converters can also be selected or bypassed which are provided for the first 8 AES streams derived from the input audio crossbar



Note: If any Dolby E signal or other Audio data is passed through the processing stage, the processing will be deactivated, so the audio data will not be modified (controls will be greyed out). Settings will be set back to the original value if PCM audio will be switched to the same path.

AES Out Tab

This section is used to configure the external AES outputs. 4 outputs are provided and any of the internal audio signals can be routed to the external outputs if required.



All inputs to the crossbar are shown horizontally and the 4 x External AES outputs are shown at the bottom of the screen. Selecting a cross point will route the required signal to the selected AES output. There is also a “mute” function for each AES output if required.

When a cross point is selected it will select the AES pair (left and right channel) However, these cross points are Mono in nature. Please refer to the section “Setting Mono Cross Points” below for details on how to use the mono cross point functionality.

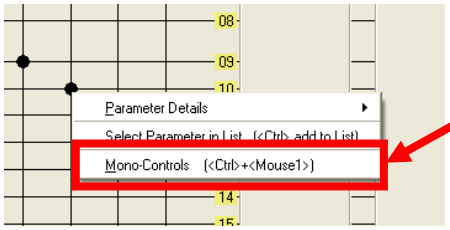
***Note.** All selections made for the AES outputs on the crossbar MUST be made from the same timing zone or audio disturbances may occur. This means all crossbar selections must be from either the yellow / blue or green timing zones and not a mixture.*

Setting Mono Cross Points

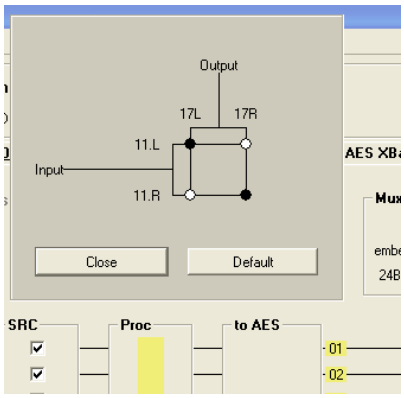
This technique of selecting mono cross points is patent pending

To keep the GUI simplified the default operation of the External AES output crossbar and the three individual output embedder cross bars are AES in nature, meaning selecting a cross point with the mouse will switch both channels (left and right) in the AES pair. Mono selections are possible, instructions below.

With the cursor positioned over the required cross point, click the right button on the mouse to display a submenu:



Select “Mono Controls” from this small submenu and a new mini cross point control box is displayed

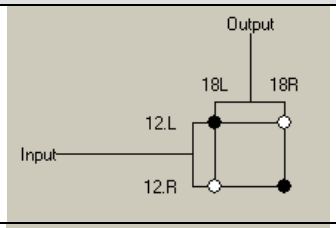
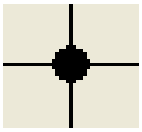
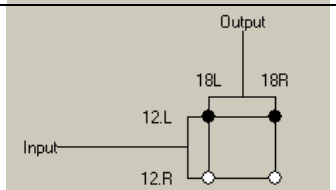
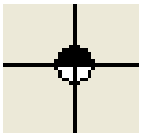
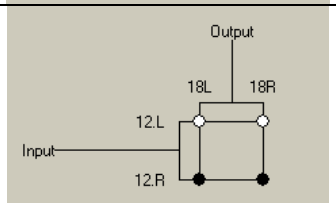
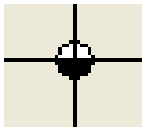
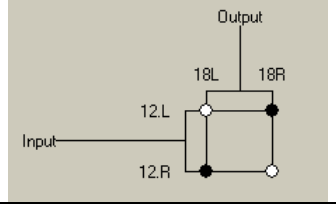
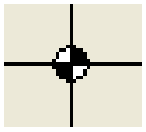


The Mini cross bar looks like shown, and permits full control over the routing of the left and right audio channels within the AES cross point selected.

Simply select the desired routing by clicking the mouse on a cross point and then click “close” to apply the selection and close the dialog.

The default button will return the selection to the standard “default” settings

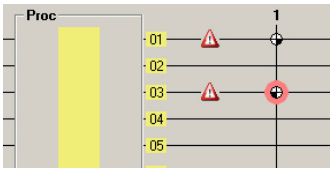
When a cross point has been changed, the graphical cross point selection changes to indicate the underlying configuration. This is shown below:

Status	Cross Point Selection	GUI Indication
Default		
Left input channel into both output channels		
Right input channel into both output channels		
Left and right channel swapped		

If the mouse pointer is positioned on the cross point using the “ctrl” key and left mouse button click will toggle the settings. Use of this function takes a little practice - as the position of the pointer on the correct cross point quadrant is critical. We recommend you select the mini crossbar as specified above, as this provides the most precise control.

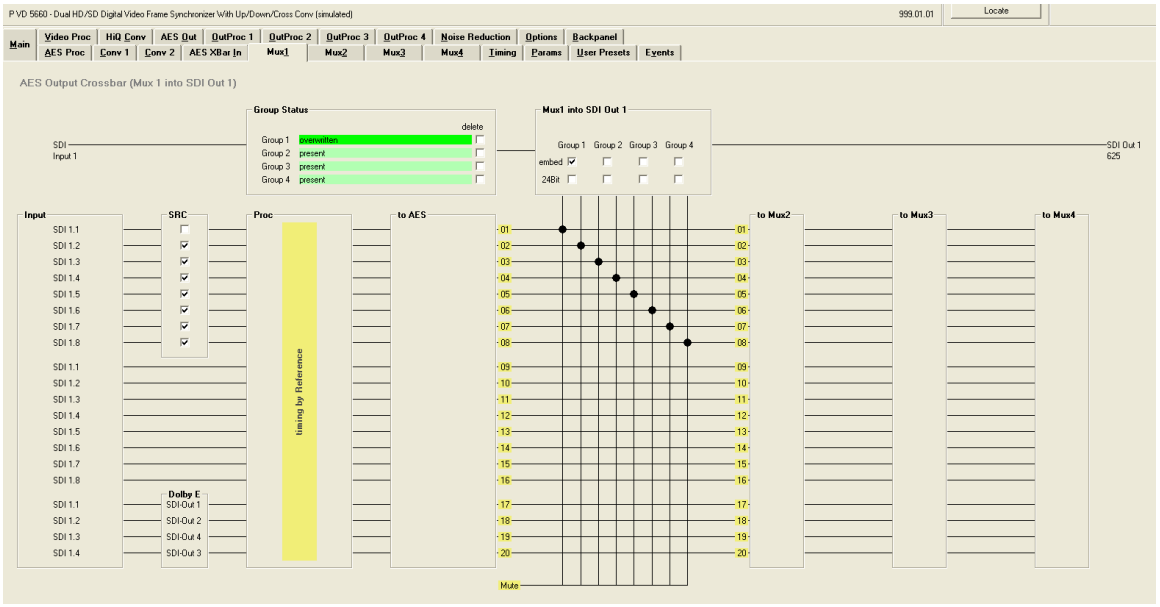
Pressing CTRL+ALT and clicking the left mouse button will result in a channel swap.

Note: If a Dolby E signal (or any other compressed Audio Data) is connected to the cross point, and if a mono control is performed then a warning will be indicated.



Output Mux Tabs

Each output has a separate embedder, which can embed the full AES payload (8xAES) back into the output SDI signals. A separate tab is provided for each embedder.



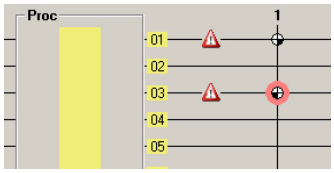
All of the internal audio from pathways 1, 2 and 3 are made available as inputs to each embedder. The embedder can be seen at the top of the GUI and it’s possible to quickly disable or enable an individual AES “Group” using the checkbox provided.

These cross points also provide full mono control; please refer to the previous section “Setting Mono Cross Points” for details.

Each channel into the embedder can be individually “muted” as required using the “mute” cross bar selections at the bottom of the GUI.

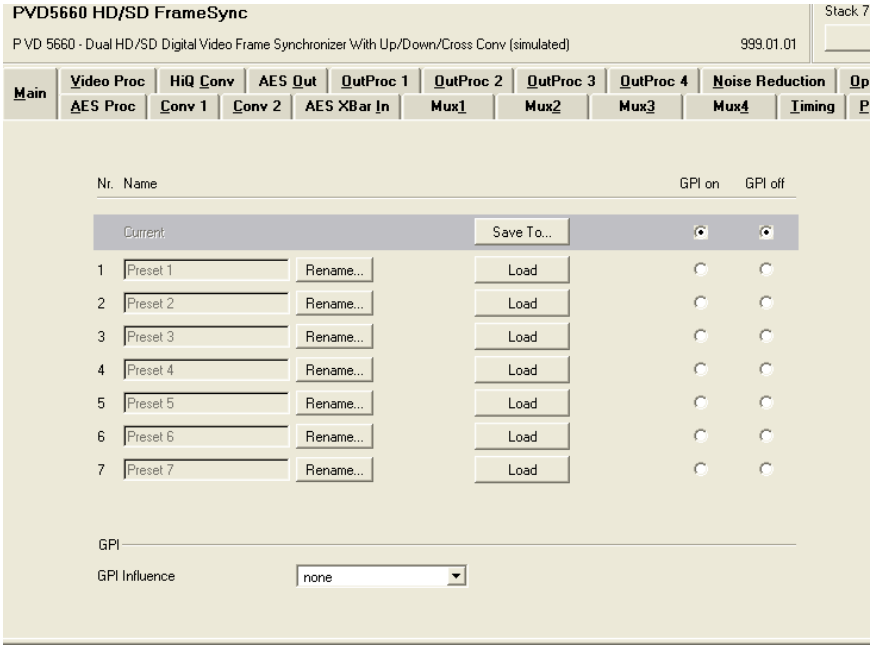
The remaining 3 embedders (Mux 2, Mux 3 and MUX 4) are identical in operation.

Note: If a Dolby E signal (or any other compressed Audio Data) is connected to the cross point, and if a mono control is performed then a warning will be indicated.



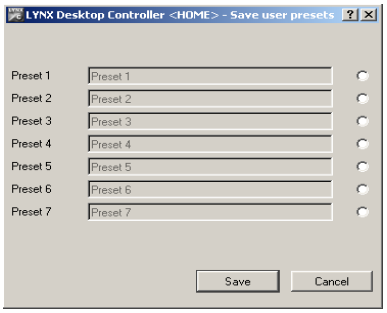
User Presets Tab

This Tab allows the user to store and recall 7 sets of additional module presets (settings), and also configure GPI switching between any two of the 3 stored presets and / or the current module settings (8 total). The presets are stored in module flash ram and will survive power cycles.



To save a preset

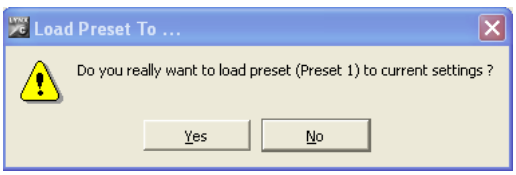
1. First make all the module settings required using the various settings provided for the module.
2. Click the button “Save To” to switch up the dialog box:



3. Using the radio button to select the preset location you wish to save the settings to and type in a name.
4. Click “Save” and the all the current module settings are stored in the named preset.
5. Use the “rename” button to rename any stored preset

To load a saved preset

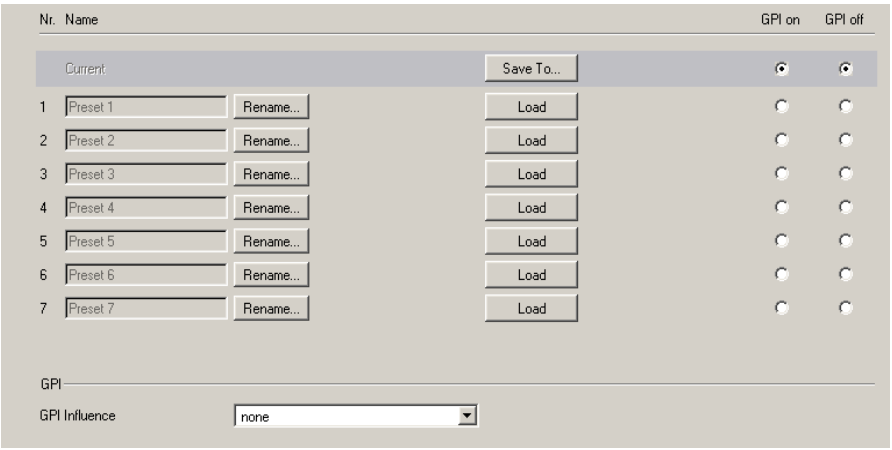
To load a saved preset into the module simply click on the “load” button adjacent to the preset, this will show the dialog shown below asking you to confirm your selection (as this will overwrite any current stored module settings)



Setting GPI control of Preset selections

In some cases its desirable to switch quickly between two sets of stored presets, this can be achieved using the external GPI trigger

1. Next to each preset there are two radio buttons which allow for the selection of GPI switching



2. Simple select any two of the stored presets and the required GPI polarity.

3. Set the GPI influence to “switch user presets” the presets are now toggled based upon the polarity external GPI input signal.

4. The active Preset is indicated by the grey bar behind the Preset (in the picture above behind the “Current” preset)

Note: *If a Preset (except “Current”) is active, all control parameters for the P VD 5660 are greyed out.*

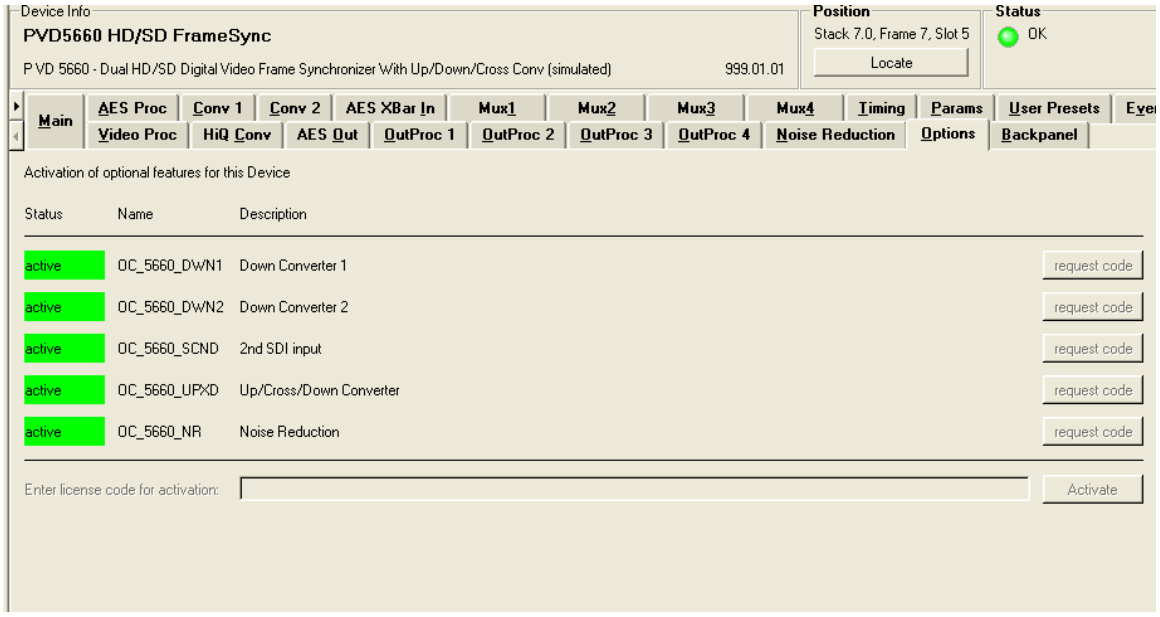
GPI Influence

The drop down box for GPI influence is used to set the function of the GPI input, in this case we have configured the GPI to switch between 2 stored presets. Other settings include:

- None
- Switch video inputs
- Freeze input 2
- Freeze input 2
- Freeze both inputs
- Switch user presets

Options Tab

One tab on the GUI is reserved for “Options“. This is where the option license codes are entered to unlock the embedded firmware options.



If the module was purchased with options pre-installed then you will see the option status as green (Active).

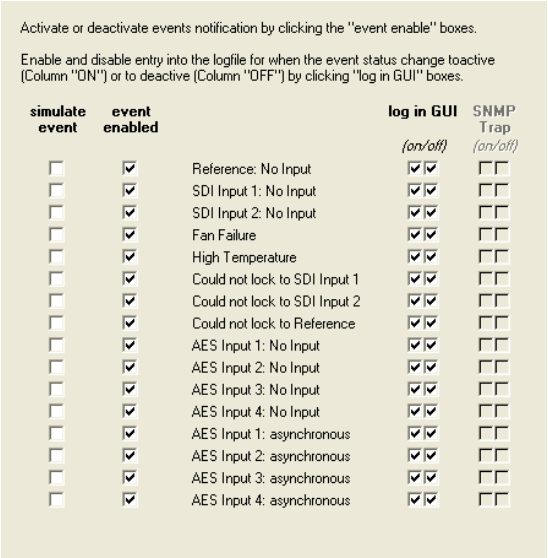
If you would like to add any option after delivery, then you will need to purchase the specific license codes from LYNX Technik.

Click the “request code” button next to the channel you wish to activate. A number will be displayed, Please forward this number with your purchase order to your authorized LYNX dealer or representative. When you receive the license string simply type it (or paste it using the windows clipboard) into the area provided and press “activate”.

Activation is confirmed when the option status turns green.

Events Tab

The Events Tab is where the module alarming and error notifications are configured for the module.


Activate or deactivate events notification by clicking the "event enable" boxes.
Enable and disable entry into the logfile for when the event status change toactive (Column "ON") or to deactive (Column "OFF") by clicking "log in GUI" boxes.
simulate event
event enabled
log in GUI
(on/off)
SNMP Trap
(on/off)
Reference: No Input
SDI Input 1: No Input
SDI Input 2: No Input
Fan Failure
High Temperature
Could not lock to SDI Input 1
Could not lock to SDI Input 2
Could not lock to Reference
AES Input 1: No Input
AES Input 2: No Input
AES Input 3: No Input
AES Input 4: No Input
AES Input 1: asynchronous
AES Input 2: asynchronous
AES Input 3: asynchronous
AES Input 4: asynchronous

The GUI has an integrated error log, which is a simple text log file stored in the controller PC. This will record an event and timestamp it. The log can be seen at the bottom of the GUI screen and can be scrolled through using the scrolling bar.

Log in GUI Function

Events are selectable, you can chose if you want to record a particular event in the log (or not) or configure it to only record one side of the event. (*For example you might want to log when a SDI input was removed but do not want to log when it came back*). The ON/OFF trigger can be configured for each of the available events shown in the list and is setup using the checkboxes provided.

Alarm Activation

By default all alarm conditions are activated (checked), by de-selecting a specific alarm condition I this column you are telling the module to ignore this condition completely. It will not color the alarm LED, log and event in the GUI or send a SNMP trap. This is useful if for example you never have anything connected to input 2 and want the card to ignore this input condition completely you would simply de-select “SDI Input 2 No Input” and it will be ignored.

SNMP Support

If the system is using a RCT 5030 Master Controller and the SNMP option is installed then the “SNMP Trap” columns become available.

Here you can configure what events you would like to transmit a “SNMP trap” for over the network. (This has no impact or influence over the internally error log maintained by the LYNX control system)

(Internal LYNX error logging and external SNMP traps can be configured independently).

> **Note.** *The simulated event is part of the GUI simulator and allows us to force a particular error condition for testing and demonstration purposes.*

Specifications

Video Inputs	
Signal Type	Serial digital video SMPTE 292M, 344M, 259M-C
Input standards	See table on page 8
No. of inputs	2 inputs**, (second input optional)**
Connector	BNC
Impedance	75 Ohm
Cable Equalization	Up to 250m Belden 8281 (270MHz) Up to 140m Belden 1694A (1.485GHz)
Return Loss	> 15 dB (270MHz) > 10dB (1.485GHz)
Reference Input	
Signal Type	Analog Bi-level / Tri-level (auto detect) cross lock compatible. Standards see table on page 10
No of inputs	1 x External or internal rack reference (selectable)
Connection	BNC
Impedance	75 Ohm
Video Outputs	
Signal Type	Serial digital video SMPTE 292M, 344M, 259M-C
Output standards	See table on page 9
No. Of outputs	4 separate outputs with 2 x SDI out of each output (8 total) (mapped to any available internal resource)
Connector	BNC
Impedance	75 Ohms
Jitter	< 0.2 UI (270MHz) < 0.2UI (1.485GHz, 100kHz)
Return Loss	> 15 dB (1.5GHz)
Video Processing	
Delay adjustment range	Up to 3 frames of programmable delay in pixel / line / frame increments. Independent for all 3 outputs
Minimum delay	Variable, depending on selected functionality and installed options. Please refer to “Fixed Video Delays” table in this manual
Video adjustments	Gain / Saturation / Hue / Black Level
Aperture correction	Horizontal only, adjustable for each output channel (3)
Color space conversion	601 > 709 or 709 > 601 or transparent (selectable) **Note.** Requires conversion option(s)
AES Audio Inputs / outputs	
Signal	PVD 5660 B = AES3 id un-balanced PVD 5660 D = AES3 balanced
No. of inputs / outputs	4 x AES in and 4 x AES out (assignable)
Connectors	PVD 5660 B = BNC 75 ohm PVD 5660 D = Female 25 pin SubD, 110 ohm
Coupling	Transformer
Audio Processing	
De-embedder	De-embed all audio (4 audio groups = 8xAES) from each input source.
Audio input matrix	20 channel AES audio input crossbar provides channel assignment prior to processing.
Audio pathways	Multiple internal paths: **Pathway 1**= 8 x AES routed through SRC (sample rate converters) and full audio processing (gain / phase invert / mute / overload and silence detection) **Pathway 2** =8 x AES routed through delay only **Pathway 3** = 4 x AES containing 4 x Dolby E synchronizers **Pathway 4** = 4 x AES bypasses all processing synchronized to input 1 **Pathway 5** = 4 x AES bypasses all processing synchronized to input 2
Audio delay	Audio is delayed to match the video delay and will automatically track the frame synchronizer. User adjustment of 0.330 second (in ms) is provided

Audio Embedders	Independent embedders apply 4 audio groups (8 AES) into each output channel. User selectable. (Pathway 1, 2 and 3 only)
Operating Modes	
Frame Sync	Basic SD / HD Multi-rate Frame Synchronizer
Down conversion + ARC + frame sync	Requires Firmware option for Down Conversion
Control	
Local Controls	Local alphanumeric display with integrated menu system for setting “basic” module parameters.
Remote Control	Comprehensive remote control and status monitoring supported when used with a LYNX Controller option. The use of the control system is mandated for this module
External GPI	Single GPI input on BNC connector. GPI influence configured in control system.
Electrical Specifications	
Operating Voltage	12 VDC
Power Consumption	20 W
Safety	IEC 60950/ EN 60950/ VDE 0805
Mechanical	
Size	283mm x 78mm
Weight	CardModule 160g, connector plate 100g
Rack space	Requires 2 slots in rack frame (max 5 modules per frame)
Ambient	
Temperature	5°C to 40°C Maintaining specifications
Humidity	90% Max non condensing

Service

Parts List

Due to the very dense design and high level of integration there the module is not user serviceable. Please contact LYNX for repairs or to request an exchange unit.

There is one consumable part used on this module which is the cooling fan. A service kit is available to exchange the fan. Ordering information below.

Part type: ***Cooling Fan Service Kit Series 5000 CardModules***

Technical Support

If you are experiencing problems, or have questions please contact your local distributor for further assistance.

Technical support is also available from our website.

Please do not return products to LYNX without an RMA. Please contact your authorized dealer or reseller for more details.

More detailed product information and product updates may be available on our web site:

www.lynx-technik.com

Contact Information

Please contact your local distributor; this is your local and fastest method for obtaining support and sales information.

LYNX Technik can be contacted directly using the information below.

Address LYNX Technik AG
Brunnenweg 3
D-64331 Weiterstadt
Germany

Website www.lynx-technik.com

E-Mail info@lynx-technik.com

LYNX Technik manufactures a complete range of high quality modular products for broadcast and Professional markets, please contact your local representative or visit our web site for more product information.